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ON THE CONSTRUCTION OF A SERVICEABLE TELESCOPE MOUNTING FROM DISCARDED AUTOMOBILE PARTS.

By CLARENDON IONS.

While there is a fairly complete literature available to the amateur, dealing with the construction of mirrors for reflecting telescopes, very little information of practical value can be gleaned regarding mountings.

As every amateur who has tried it will know, the securing of patterns and castings and the machining of parts for a rigid, yet smooth working, mounting with clamps and circles is a difficult and expensive undertaking.

It is therefore of interest that discarded Ford automobile parts, obtainable almost for the taking at repair garages and junk yards everywhere, are perfectly adaptable to the construction of mountings to carry telescopes of any probable weight within the scope of amateur construction.

While this description will be confined to the subject of such a mounting, constructed by the writer, it may be appropriate to give the specifications of the telescope it carries, constructed at the same time, so that upon completion of the mirror, the mounting was ready to be utilized in testing for figure at focus.

The mirror was ground from a disc of commercial plate glass 1½ inches thick by 10 inches diameter, to a spherical radius of 144 inches giving focal length of 72 inches, and was figured to a paraboloid of 2/3 the conventional correction of $2F + R^2/4F$, to compensate for distortion in the early observing hours due to radiation of accumulated specific heat (Wassel and Ellison).

Polishing and figuring were done on a lap of rosin with 20 per cent beeswax (Fullan) and silvering by Ritchey's process, these formulae apparently working best in our southern climate.

Foucault's test with artificial star at center of curvature was used for the modified correction at each zone, later changed to test at focus in the mounting on actual stars.

A tube of 22 gauge sheet metal, 12 inches by 72 inches, was fitted to rotate in slip rings turned off from discarded automobile brake drums. A wooden counter cell with three adjusting screws was arranged to carry the mirror cell on a pivot with spring clamp, to permit rotating

speculum if necessary to correct astigmatism due to axial stress or flexure in the glass (Draper and Maskelyne).

The reflected pencil was intercepted 10 inches inside focus by an elliptical silvered flat with adjustment provided for the reflection angles, as well as for de-centering the secondary if necessary, to test for Herschelian aberration (Draper).

The weight of the finished telescope with its counterpoises carried by the hour axis approximated 196 pounds.

The annexed photograph-diagram will illustrate details of construction and it is worth noting that the somewhat clumsy looking but easily constructed wooden cradle, carrying the tube suspension rings, was originally intended as a test frame, but has worked so well that it will not be discarded.

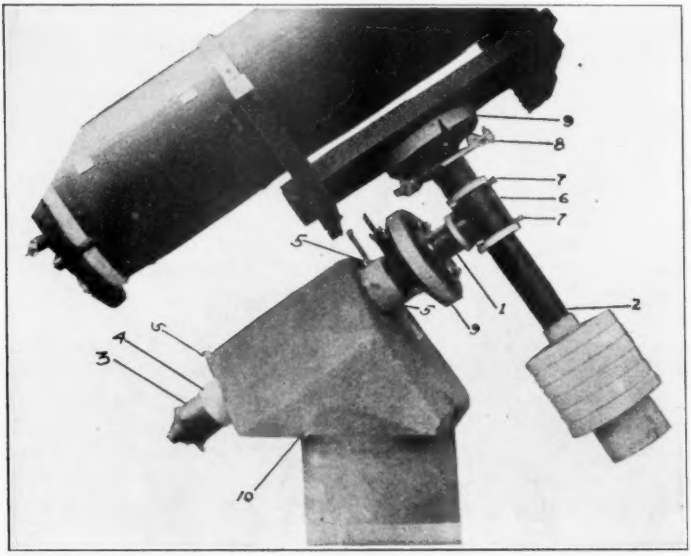

FIG. 1. Showing details of mounting of Mr. Ions' telescope.

ASSEMBLY OF PARTS AND CONSTRUCTION OF MOUNTING.

The automobile parts required consisted of two Ford rear axle assemblies, omitting differential parts, i. e. axle housings (either right or left) with axles, hubs, brake drums and shoes, roller bearings and sleeves, rear spring perches and the necessary assembling nuts and bolts. The manufacturer's list on these parts new is $27.20, but with discrimination in selecting them, second hand parts were secured at a fraction of this cost, in some respects superior for the purpose in hand

to new ones. New axles, however, are recommended in all cases, and the two cost $3.00.

In addition to the automobile parts, a section of rolled steel well pipe, 3½ inches diameter (4 would do), 18 inches long; a section 2 inches long from the threaded end of a 2-inch pipe; and a malleable iron pipe tee, 2½ by 2 inches, were required.

The machinery necessary to adapt the parts consisted of chucking one axle in lathe and turning its central parts down to same size as the machined bearing parts. One hub was turned off to receive the 2-inch threaded pipe end (1 Fig. 1), which was cold pressed in place. One axle housing was sawed off above the bell-shaped differential case (2 Fig. 1), and reamed out to receive bearing sleeve. The other axle

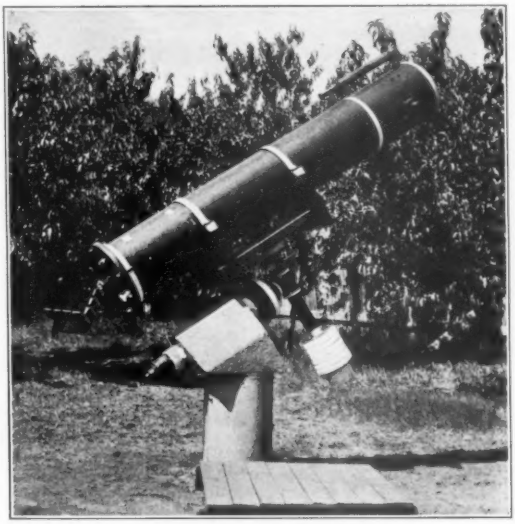

FIG. 2. The completed telescope.

housing had its differential case turned off (3 Fig. 1) so it would pass through the 3½-inch well pipe. The latter (4 Fig. 1) received four ⅜-inch tapped holes (5 Fig. 1) on quarters at each end,—likewise each 2½-inch end of the tee (6 Fig. 1) was drilled and tapped for three 5/16-inch set screws (7 Fig. 1).

The assembly was made as follows: The section of well pipe was placed in a small roof-shaped wooden form, edges of form trued with plane, two wedge-shaped sides added, cut to angle of the local latitude, ends closed in, the whole inverted, leveled and form poured full of concrete encircling the section of pipe. Some wire netting had been placed as reinforcement and, before setting, a number of old bolts and rods were put in position to project. This made the concrete equatorial

head, and when it had hardened, the form was knocked off and a circular metal form was placed in ground at suitable height and depth, filled with rock and concrete, and the equatorial head was placed approximately in the meridian over this form, its projecting reinforcement engaging the soft concrete at top of pillar-form, making a perfect union (10 Fig. 1).

It will be noted that the section of well pipe (4 Fig. 1) was so placed in its form that one set of tapped holes would be vertical and one set horizontal when in position. Two cup-pointed set screws were placed in vertical holes at south end, two placed horizontally at north end, for adjustment in altitude and azimuth, while two round-nosed cap screws

FIG. 3. Showing the eyepiece, outside, and the flat mirror, inside the tube.

were put in the complementary holes to act as guides on final adjustment. The long housing (3 Fig. 1) was slipped into place in this pipe and secured by the set and cap screws. At this point excellent preliminary adjustments were made by improvising cross wires and sighting on Polaris at transit and elongation through this housing. Brake shoes and spring perches were added to both housings.

The machined hub and nipple (1 Fig. 1) were assembled on undressed axle, brake drum bolted in place, tee (6 Fig. 1) screwed firmly on nipple, and the whole assembled in housing with bearings in the usual manner, this finishing the polar axis.

The machined axle was also assembled in the regular way on shortened housing (2 Fig. 1), which was slipped through the tee (6 Fig. 1) and secured by three set screws (7 Fig. 1), this permitting precise ad-

justment to make the axes perpendicular to each other. The projecting part of this axle received the counterweights.

Two small 5/16-inch yoke bolts (8 Fig. 1) were cut from old brake rods, threaded, attached to brake cam, run through spring perches and finished with wing nuts. These made perfect clamps, adjustable from free running disengagement, through any desired degree of friction, to a positive clamp. The faces of the brake drums (9 Fig. 1) were graduated in hours and degrees and provided with indicators, the latter being secured by small bolts passed through the bolt holes intended for the auto radius rods.

In the telescope illustrated, a wooden cradle is carried on the unmodified hub of declination axis, six bolts passing through brake drum,

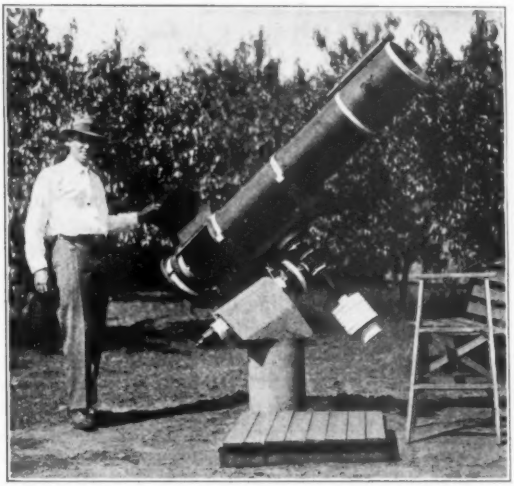

FIG. 4. Mr. Ions and his reflecting telescope, showing the principal mirror.

hub and base of cradle. This detail might be varied to suit construction of tube. It had been intended that a pipe flange should be carried on the declination axis, similar to placing of tee on polar axis, but the wooden cradle worked satisfactorily.

It will be noted that the essential merit of this mounting was its cheapness, the ease with which the parts could be obtained, its rigid yet smooth working capacity for carrying any weight required and the perfect clamps and circles provided by the brake parts.

Another noteworthy detail is the arrangement of set screws as suspension for both axes, whereby great delicacy of adjustment is secured without sacrificing strength or rigidity.

This same arrangement would be practical for an alt-azimuth in-

strument by the simple expedient of leaving the bell-shaped differential end of one axle housing in place, for base of azimuth axis, bolting it to floor or platform through the bolt holes provided in its original construction.

It should be understood that many of the details represent selection from one of numerous alternatives of construction. Further details of slow motion and clock drive remain to be worked out.

Therefore, the amateur following this plan will find unlimited room for improvements and modifications. The author of this description will appreciate letters from anyone pointing out any method by which the scheme can be bettered.

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AN INDEX TO THE CONSTELLATIONS.

By FRANK SCHLESINGER and ALICE H. POND.

Yale University Observatory is engaged in collecting and keeping up to date information of several kinds concerning many stars. These stars are as usual arranged in our lists in the order of their right ascensions. Astronomers who have had experience in similar work will be familiar with the difficulty of finding or assigning to their proper places stars that are indicated in the original sources by some kind of name without any indication of their position. This is especially true of stars to which Bayer assigned Greek letters, and of variable stars known by one or more capital Roman letters, beginning with R. To facilitate our work we have compiled a manuscript index to the constellations, and with the expectation that this will prove useful in other institutions this index is printed here.

The constellations are arranged in alphabetical order. The heading gives the nominative and genitive names, a three-letter abbreviation, a four-letter abbreviation, and the limits in declination. This is followed by the right ascension for 1900 of all the Greek-letter stars; and these by the variable stars. The novae, if any, complete the list; they are inserted in the order of their discovery and are designated by N 1, N 2, etc. The following variables and novae having unusual designations are included:

l Cari	*u* Herc
B Cass (Tycho's Nova)	*x* Pavo
P Cygn (Nova)	L_a Pupp
Q Cygn (Nova)	*d* Serp
g Herc	N Velr (not a Nova)

The three-letter abbreviation is that adopted at the 1922 meeting of the International Astronomical Union (see its *Transactions,* Volume 1,

AN INDEX TO THE CONSTELLATIONS.

Andromeda Andromedae			Andromeda (Continued)			Apus Apodis			Aquarius (Continued)			Aquila (Continued)		
And		Andr		h	m	Aps		Apds		h	m		h	m
+22°	to	+53°	TV	22	53.5	−67°	to	−81°	ω^2	23	37.5	ν	19	21.4
	h	m	TW	23	58.2		h	m	R	23	38.6	ξ	19	49.4
α	0	3.2	TX	1	16.2	α	14	35.4	S	22	51.8	o	19	46.2
β	1	4.1	TY	23	10.0	β	16	28.8	T	20	44.7	π	19	44.0
γ	1	57.8	TZ	23	45.9	γ	16	18.1	U	21	57.9	ρ	20	9.6
δ	0	34.0	UU	0	38.6	δ	16	5.4	V	20	41.8	σ	19	34.3
ϵ	0	33.3	UV	1	23.6	ϵ	14	10.3	W	20	41.2	τ	19	59.3
ζ	0	42.1	UW	0	9.0	ζ	17	11.5	X	22	13.2	υ	19	40.8
η	0	51.9	UX	2	27.0	η	14	5.7	Y	20	39.2	ϕ	19	51.5
θ	0	11.9	UY	2	32.2	θ	13	55.6	Z	23	47.1	χ	19	37.9
ι	23	33.2	UZ	1	10.4	ι	17	10.9	RR	21	9.8	ψ	19	39.9
κ	23	35.5	VV	23	33.8	κ^1	15	20.6	RS	21	5.7	ω	19	13.1
λ	23	32.7	VW	23	59.5	κ^2	15	29.3	RT	22	17.7	R	19	1.6
μ	0	51.2	VX	0	14.6	R	14	46.5	RU	23	19.2	S	20	7.0
ν	0	44.3	VY	22	57.2	S	14	59.4	RV	21	0.7	T	18	40.9
ξ	1	16.5	VZ	0	9.4	T	13	46.1	RW	21	18.0	U	19	24.0
o	22	57.3	WW	23	40.0	U	15	16.1	RX	21	7.2	V	18	59.1
π	0	31.5	WX	0	40.3	V	14	55.0	RY	21	14.8	W	19	10.0
ρ	0	15.9	WY	23	36.6				RZ	21	17.8	X	19	46.5
σ	0	13.1							SS	22	14.5	Y	not var	
τ	1	34.7							ST	22	15.8	Z	20	9.8
υ	1	30.9							SU	22	46.8	RR	19	52.4
ϕ	1	3.7							SV	23	17.6	RS	19	53.7
χ	1	33.4							SW	21	10.2	RT	19	33.3
ψ	23	41.1							SX	21	31.1	RU	20	8.0
ω	1	21.7							SY	21	45.5	RV	19	36.0
R	0	18.8							SZ	22	37.4	RW	20	7.3
S	0	37.2							TT	22	49.7	RX	19	40.4
T	0	17.2	Antlia			Aquarius			TU	21	2.5	RY	19	43.7
U	1	9.8	Antliae			Aquarii			TV	20	48.6	RZ	19	49.1
V	0	44.7	Ant		Antl	Aqr		Aqar	TW	20	58.9	SS	19	27.8
W	2	11.2	−24°	to	−50°	+ 2°	to	−25°	TX	21	1.6	ST	19	44.6
X	0	10.9	α	10	22.6	α	22	0.6				SU	19	31.0
Y	1	33.8	δ	10	25.0	β	21	26.3				SV	19	34.3
Z	23	28.8	ϵ	9	25.1	γ	22	16.5				SW	19	46.0
RR	0	46.0	ζ	9	26.9	δ	22	49.3				SX	19	46.2
RS	23	50.3	η	9	54.6	ϵ	20	42.3				SY	20	2.4
RT	23	6.7	θ	9	39.7	ζ	22	23.7				SZ	18	59.6
RU	1	32.8	ι	10	52.1	η	22	30.2				TT	19	3.2
RV	2	4.6	R	10	5.4	θ	22	11.6				TU	19	22.6
RW	0	41.9	S	9	27.9	ι	22	1.0				TV	20	7.9
RX	0	59.0	T	9	29.7	κ	22	32.6				TW	19	46.3
RY	23	15.9	U	10	30.8	λ	22	47.4				TX	20	1.6
RZ	23	5.0	V	10	16.7	μ	20	47.3				TY	19	9.8
SS	23	7.0	W	9	46.7	ν	21	4.1				TZ	20	25.0
ST	23	33.8	X	10	2.2	ξ	21	32.4				UU	19	52.0
SU	23	59.5	Y	10	4.2	o	21	58.1				UV	18	54.0
SV	23	59.2	Z	10	41.4	π	22	20.2				UW	18	52.4
SW	0	18.5	RR	9	31.6	ρ	22	14.9				UX	18	54.9
SX	1	27.6				σ	22	25.4				UY	18	55.5
SY	0	8.0				τ	22	44.3				UZ	19	8.0
SZ	22	55.0				υ	22	29.2				VV	19	43.0
TT	23	8.8				ϕ	23	9.2				VW	18	48.2
TU	0	27.1				χ	23	11.7				VX	18	54.9
						ψ^1	23	10.7						
						ψ^2	23	12.7						
						ψ^3	23	13.8						
						ω^1	23	34.6						

Aquila Aquilae					
Aql		Aqil			
+21°	to	−12°			
α	19	45.9			
β	19	50.4			
γ	19	41.5			
δ	19	20.5			
ϵ	18	55.1			
ζ	19	0.8			
η	19	47.4			
θ	20	6.1			
ι	19	31.5			
κ	19	31.5			
λ	19	0.9			
μ	19	29.2			

Aquila (Continued)

	h	m
VY	18	58.0
VZ	18	59.6
WW	19	10.6
WX	19	43.7
WY	19	47.2
WZ	20	9.6
XX	19	46.0
XY	19	9.8
XZ	20	16.8
N 1	19	15.3
N 2	18	56.8
N 3	18	43.8
N 4	19	13.3

Ara
Arae
Ara Arae
—45° to —68°

α	17	24.1
β	17	17.0
γ	17	17.0
δ	17	22.1
ϵ^1	16	51.6
ϵ^2	16	55.2
ζ	16	50.4
η	16	41.2
θ	17	58.9
ι	17	15.8
κ	17	18.8
λ	17	32.7
μ	17	36.2
π	17	29.9
σ	17	28.2
R	16	31.4
S	17	51.4
T	16	54.4
U	17	45.7
V	17	47.3
W	17	49.2
X	16	28.3
Y	16	30.4
Z	16	46.0
RR	17	20.1
RS	16	49.4
RT	17	18.0
RU	17	20.0
RV	17	23.3
RW	17	26.3
RX	16	43.6
RY	17	13.2
RZ	17	40.3
SS	17	50.5
ST	16	51.5
SU	16	54.5
SV	16	58.4
SW	17	11.2

Ara (Continued)

	h	m
SX	18	1.8
SY	16	27.3
SZ	17	2.2
TT	17	56.4
TU	17	12.1
N 1	16	33.0

Aries
Arietis
Ari Aris
+10° to +29°

α	2	1.5
β	1	49.1
γ	1	48.1
δ	3	5.9
ε	2	53.5
ζ	3	9.2
η	2	7.2
θ	2	12.6
ι	1	51.9
κ	2	1.0
λ	1	52.4
μ	2	36.7
ν	2	33.1
ξ	2	19.5
ο	2	39.0
π	2	43.7
ρ	2	50.8
σ	2	46.0
τ	3	15.5
R	2	10.4
S	1	59.2
T	2	42.8
U	3	5.5
V	2	9.6
W	3	14.6
X	3	3.1
Y	2	35.0
Z	3	2.3
RR	1	50.3
N 1	2	42.9
N 2	3	19.3

Auriga
Aurigae
Aur Auri
+27° to +57°

α	5	9.3
β	5	52.2
δ	5	51.3
ε	4	54.8
ζ	4	55.5

Auriga (Continued)

	h	m
η	4	59.5
θ	5	52.9
ι	4	50.5
κ	6	9.0
λ	5	12.1
μ	5	6.6
ν	5	44.6
ξ	5	46.5
ο	5	38.2
π	5	52.5
ρ	5	14.7
σ	5	17.9
τ	5	42.3
υ	5	44.2
φ	5	21.0
χ	5	26.2
ψ^1	6	17.2
ψ^2	6	32.2
ψ^3	6	31.9
ψ^4	6	35.8
ψ^5	6	39.5
ψ^6	6	40.0
ψ^7	6	43.7
ψ^8	6	46.8
ψ^9	6	49.1
ψ^{10}	6	50.3
R	5	9.2
S	5	20.5
T	5	25.6
U	5	35.6
V	6	16.5
W	5	20.2
X	6	4.4
Y	5	21.5
Z	5	53.6
RR	6	4.9
RS	5	56.4
RT	6	22.1
RU	5	33.3
RV	6	27.6
RW	5	1.4
RX	4	54.5
RY	5	11.6
RZ	5	42.9
SS	6	5.8
ST	6	7.5
SU	4	49.6
SV	5	56.2
SW	4	32.0
SX	5	4.6
SY	5	5.5
SZ	5	35.0
TT	5	2.8
TU	6	28.2
TV	4	50.6
TW	5	49.7
TX	5	2.2
TY	4	51.4
TZ	7	4.6
UU	6	29.7

Auriga (Continued)

	h	m
UV	5	15.3
UW	6	50.3
UX	5	8.3
UY	4	45.4
UZ	5	8.2
VV	6	6.3
VW	6	10.7
VX	7	21.6
VY	6	2.4
VZ	6	7.0
WW	6	25.9
WX	4	59.0
WY	5	34.9
WZ	5	38.5
XX	5	40.1
XY	5	48.7
XZ	5	57.0
YY	5	57.0
YZ	5	8.4
ZZ	5	38.6
AA	6	34.0
AB	4	49.3
AC	5	19.4
AD	5	22.1

Boötes
Boötis
Boo Boot
+ 5° to +56°

α	14	11.1
β	14	58.2
γ	14	28.1
δ	15	11.5
ε	14	40.6
ζ	14	36.4
η	13	49.9
θ	14	21.8
ι	14	12.6
κ	14	9.9
λ	14	12.6
μ	15	20.7
ν	15	27.8
ξ	14	46.8
ο	14	40.6
π	14	36.0
ρ	14	27.5
σ	14	30.3
τ	13	42.5
υ	13	44.7
φ	15	34.2
χ	15	10.3
ψ	15	0.2
ω	14	57.7
R	14	32.8
S	14	19.5
T	14	9.4

Boötes (Continued)

	h	m
U	14	49.7
V	14	25.7
W	not var	
X	not var	
Y	14	17.4
Z	14	1.6
RR	14	43.2
RS	14	29.3
RT	15	13.4
RU	14	41.5
RV	14	35.0
RW	14	37.0
RX	14	19.7
RY	14	45.2
RZ	13	58.7
SS	15	9.7
ST	15	26.8
SU	14	25.1
SV	14	30.1
SW	14	23.0

Caelum
Caeli
Cae Cael
—30° to —48°

α	4	37.3
β	4	38.5
γ	5	0.8
δ	4	27.8
ζ	4	43.9
R	4	37.0
S	4	53.2
T	4	43.8

Camelopardus
Camelopardi
Cam Caml
+52° to +87°

α	4	44.1
β	4	54.5
γ	3	39.7
R	14	25.1
S	5	30.2
T	4	30.4
U	3	33.2
V	5	49.4
W	6	12.2
X	4	32.8
Y	7	27.8
Z	8	14.0
RR	5	23.4
RS	8	36.9

Camelopardus (Continued)

	h	m
RT	6	25.6
RU	7	10.9
RV	4	22.4
RW	3	46.2
RX	3	56.7
RY	4	21.4
RZ	6	23.7
SS	7	4.2
ST	4	40.8
SU	6	25.4

Cancer
Cancri
Cnc Cncr
+ 7° to +35°

	h	m
α	8	53.0
β	8	11.1
γ	8	37.5
δ	8	39.0
ε	8	34.7
ζ	8	6.5
η	8	26.9
θ	8	25.9
ι	8	40.6
κ	9	2.3
λ	8	14.6
μ	8	1.9
ν	8	56.9
ξ	9	3.6
ο	8	51.7
π	9	10.7
ρ^1	8	46.6
ρ^2	8	49.7
σ^1	8	46.4
σ^2	8	50.8
σ^3	8	53.4
τ	9	2.0
υ^1	8	25.6
υ^2	8	27.1
ϕ^1	8	20.4
ϕ^2	8	20.7
χ	8	14.0
ψ	8	4.4
ω	7	54.9
R	8	11.0
S	8	38.2
T	8	51.0
U	8	30.0
V	8	16.0
W	9	4.0
X	8	49.8
Y	7	58.6
Z	8	16.8
RR	8	5.1
RS	9	4.6
RT	8	52.8

Cancer (Continued)

	h	m
RU	8	31.6
RV	8	3.9
RW	9	13.2
RX	8	8.7
RY	8	34.2
RZ	8	32.9
SS	8	0.5
N 1	8	29.2

Canes Venatici
Canum Venaticorum
CVn CVen
+28° to +54°

	h	m
α	12	51.4
β	12	29.0
R	13	44.7
S	not var	
T	12	25.2
U	12	42.6
V	13	15.1
W	14	2.2
X	14	0.7
Y	12	40.4
Z	12	45.1
RR	12	24.2
RS	13	6.0
RT	13	44.2
RU	13	55.1
RV	13	35.7

Canis Major
Canis Majoris
CMa CMaj
−11° to −33°

	h	m
α	6	40.7
β	6	18.3
γ	6	59.2
δ	7	4.3
ε	6	54.7
ζ	6	16.5
η	7	20.1
θ	6	49.5
ι	6	51.7
κ	6	46.1
λ	6	24.5
μ	6	51.5
ν^1	6	32.0
ν^2	6	32.3
ν^3	6	33.5
ξ^1	6	27.7

Canis Major (Continued)

	h	m
ξ^2	6	30.9
o^1	6	50.0
o^2	6	58.8
π	6	51.3
σ	6	57.7
τ	7	14.6
ω	7	10.7
R	7	14.9
S	7	5.7
T	7	17.3
U	6	14.8
V	6	39.7
W	7	3.4
X	6	52.6
Y	6	59.9
Z	6	59.0

Canis Minor
Canis Minoris
CMi CMin
+ 1° to +14°

	h	m
α	7	34.1
β	7	21.7
γ	7	22.7
δ^1	7	26.9
δ^2	7	28.0
ε	7	20.2
ζ	7	46.5
η	7	22.7
R	7	3.2
S	7	27.3
T	7	28.4
U	7	35.9
V	7	1.5
W	7	43.4

Capricornus
Capricorni
Cap Capr
− 9° to −28°

	h	m
α	20	12.3
β	20	15.4
γ	21	34.6
δ	21	41.5
ε	21	31.5
ζ	21	21.0
η	20	58.7
θ	21	0.3
ι	21	16.7
κ	21	37.1
λ	21	41.2
μ	21	47.8

Capricornus (Continued)

	h	m
ν	20	15.1
ξ	20	6.9
ο	20	24.2
π	20	21.6
ρ	20	23.2
σ	20	13.6
τ	20	33.7
υ	20	34.4
φ	21	9.9
χ	21	2.8
ψ	20	40.2
ω	20	45.9
R	20	5.7
S	20	36.0
T	21	16.5
U	20	42.6
V	21	1.8
W	20	8.6
X	21	2.8
Y	21	28.9
Z	21	5.0
RR	20	56.4
RS	21	1.7
RT	20	11.2
RU	20	26.7
RV	20	55.9
RW	20	12.2
RX	20	9.4
RY	20	1.5

Carina
Carinae
Car Cari
−50° to −75°

	h	m
α	6	21.7
β	9	12.1
ε	8	20.5
η	10	41.2
θ	10	39.4
ι	9	14.4
υ	9	44.6
χ	7	54.2
ω	10	11.4
R	9	29.7
S	10	6.2
T	10	51.3
U	10	53.7
V	8	26.7
W	not var	
X	8	29.1
Y	10	29.4
Z	10	10.4
RR	9	54.8
RS	11	3.9
RT	10	40.9
RU	9	13.4

Carina (Continued)

	h	m
RV	9	55.6
RW	9	18.2
RX	10	33.2
RY	11	15.8
RZ	10	32.8
SS	10	54.2
ST	10	12.5
SU	10	10.2
SV	9	45.3
SW	10	23.3
SX	10	42.1
SY	11	11.2
SZ	9	56.7
TT	10	17.3
TU	10	31.3
TV	10	35.0
TW	10	51.0
TX	10	54.8
TY	10	48.7
TZ	10	42.5
UU	9	26.5
UV	10	20.9
UW	10	23.2
UX	10	25.4
UY	10	28.5
UZ	10	32.6
VV	10	34.6
VW	10	34.7
VX	10	36.4
VY	10	40.6
VZ	10	47.0
WW	10	47.6
WX	10	49.9
WY	10	50.2
WZ	10	51.3
XX	10	53.4
XY	10	58.3
XZ	11	0.1
YY	10	16.8
YZ	10	24.6
ZZ	10	50.4
AA	10	18.4
AB	6	34.4
AC	7	5.1
AD	10	31.6
AE	10	56.7
AF	10	10.4
AG	10	52.2
AH	7	17.6
AI	7	45.8
AK	7	59.8
AL	8	58.0
AM	10	11.1
AN	10	12.5
AO	10	14.5
AP	10	15.8
AQ	10	18.0
AR	10	19.3
AS	10	20.9
AT	10	21.9

Carina (Continued)

	h	m
AU	10	22.2
AV	10	28.2
AW	10	29.0
AX	10	29.4
AY	10	30.8
AZ	10	31.7
BB	10	31.8
BC	10	33.7
BD	10	37.8
BE	10	37.8
BF	10	38.8
BG	10	39.0
BH	10	39.0
BI	10	39.9
BK	10	40.4
BL	10	41.1
BM	10	41.4
BN	10	41.8
BO	10	42.0
BP	10	42.9
BQ	10	43.8
BR	10	44.1
BS	10	44.4
BT	10	45.8
BU	10	46.6
BV	10	47.7
BW	10	48.0
BX	10	48.2
BY	10	49.0
BZ	10	50.2
CC	10	50.5
CD	10	53.2
CE	10	54.6
CF	10	55.1
CG	10	55.3
CH	11	0.2
CI	11	9.8
CK	10	20.9
CL	10	50.1
CM	9	45.8
l	9	42.5

Cassiopeia
Cassiopeiae
Cas Cass
+47° to +77°

	h	m
α	0	34.8
β	0	3.8
γ	0	50.7
δ	1	19.3
ε	1	47.2
ζ	0	31.4
η	0	43.0
θ	1	5.0
ι	2	20.8
κ	0	27.3

Cassiopeia (Continued)

	h	m
λ	0	26.3
μ	1	1.6
ν	0	43.2
ξ	0	36.5
ο	0	39.1
π	0	37.9
ρ	23	49.4
σ	23	53.9
τ	23	42.2
υ^1	0	49.1
υ^2	0	50.7
φ	1	13.8
χ	1	27.4
ψ	1	18.9
ω	1	48.2
R	23	53.3
S	1	12.3
T	0	17.8
U	0	40.8
V	23	7.4
W	0	49.0
X	1	49.8
Y	23	58.2
Z	23	39.7
RR	23	50.8
RS	23	32.6
RT	23	41.5
RU	1	5.2
RV	0	47.1
RW	1	30.7
RX	2	58.8
RY	23	47.2
RZ	2	39.9
SS	0	4.4
ST	0	12.2
SU	2	43.0
SV	23	34.2
SW	23	2.9
SX	0	5.5
SY	0	9.8
SZ	2	19.9
TT	0	4.9
TU	0	20.9
TV	0	13.9
TW	2	37.6
TX	2	44.3
TY	0	31.2
TZ	23	48.0
UU	23	45.7
UV	22	58.1
UW	0	30.5
UX	0	8.0
UY	22	57.8
UZ	1	6.3
VV	1	44.2
VW	0	59.5
VX	0	25.7
VY	0	45.4
VZ	1	10.4
WW	1	27.1

Cassiopeia (Continued)

	h	m
WX	1	47.1
WY	23	52.9
WZ	23	56.2
XX	1	23.0
XY	0	44.1
XZ	1	16.5
B	0	19.2

Centaurus
Centauri
Cen Cent
−30° to −65°

	h	m
α	14	32.8
β	13	56.8
γ	12	36.0
δ	12	3.2
ε	13	33.5
ζ	13	49.3
η	14	29.2
θ	14	0.8
ι	13	15.0
κ	14	52.7
λ	11	31.2
μ	13	43.6
ν	13	43.5
ξ^1	12	57.8
ξ^2	13	1.1
o^1	11	27.1
o^2	11	27.2
π	11	16.4
ρ	12	6.4
σ	12	22.6
τ	12	32.2
υ^1	13	52.5
υ^2	13	55.5
φ	13	52.2
χ	13	59.9
ψ	14	14.5
ω	13	20.8
R	14	9.4
S	12	9.2
T	13	36.0
U	12	28.0
V	14	25.4
W	11	50.0
X	11	44.2
Y	14	25.1
Z	13	34.3
RR	14	9.9
RS	11	16.1
RT	13	42.5
RU	12	4.2
RV	13	31.1
RW	11	2.9

Centaurus (Continued)

	h	m
RX	13	45.5
RY	14	43.3
RZ	12	55.6
SS	13	7.2
ST	11	5.5
SU	11	6.6
SV	11	43.1
SW	12	12.5
SX	12	15.9
SY	13	35.0
SZ	13	43.8
TT	13	13.2
TU	14	28.1
TV	12	9.3
TW	13	52.0
TX	14	27.6
TY	12	57.2
TZ	12	58.0
UU	13	15.6
UV	11	36.2
UW	12	37.6
UX	13	15.5
UY	13	10.7
UZ	11	36.2
VV	11	41.7
VW	13	27.1
VX	13	44.4
VY	11	26.5
VZ	11	47.5
WW	13	3.2
WX	13	6.4
WY	13	9.8
WZ	13	13.0
XX	13	33.8
XY	13	42.7
XZ	12	18.9
YY	12	30.2
YZ	12	48.6
ZZ	13	53.7
AA	13	53.7
AB	11	21.8
AC	11	28.4
AD	11	48.2
AE	11	57.9
AF	12	58.2
AG	13	25.2
AH	13	34.2
AI	13	48.0
AK	14	24.6
AL	12	30.5
AM	13	40.9
AN	13	42.2
AO	14	54.3
AP	14	55.0
AQ	13	59.1

Cepheus
Cephei
Cep Ceph
+53° to +88°

	h	m
α	21	16.2
β	21	27.4
γ	23	35.2
δ	22	25.5
ε	22	11.4
ζ	22	7.4
η	20	43.3
θ	20	27.9
ι	22	46.1
κ	20	12.3
λ	22	8.1
μ	21	40.4
ν	21	42.6
ξ	22	0.9
ο	23	14.5
π	23	4.7
ρ	22	29.0
R	not var	
S	21	36.5
T	21	8.2
U	0	53.4
V	23	51.8
W	22	32.6
X	21	3.6
Y	0	31.3
Z	2	12.7
RR	2	29.4
RS	4	48.6
RT	21	44.3
RU	1	8.1
RV	0	7.7
RW	22	19.4
RX	0	41.9
RY	23	18.0
RZ	22	35.7
SS	3	33.8
ST	22	26.4
SU	21	43.5
SV	22	19.6
SW	21	23.3
SX	21	0.4
SY	22	10.3
SZ	20	13.0
TT	22	2.1
TU	21	59.8
TV	22	6.9
TW	21	50.4
TX	23	48.6
TY	21	55.7
TZ	0	19.2
UU	20	36.9
UV	20	49.2
UW	20	56.9
UX	21	1.1
UY	21	5.6
N 1	20	32.7

Cetus
Ceti

Cet Ceti
+11° to −26°

	h	m
α	2	57.1
β	0	38.6
γ	2	38.1
δ	2	34.4
ε	2	34.7
ζ	1	46.5
η	1	3.6
θ	1	19.0
ι	0	14.3
κ	3	14.1
λ	2	54.4
μ	2	39.5
ν	2	30.6
ξ¹	2	7.7
ξ²	2	22.8
ο	2	14.3
π	2	39.4
ρ	2	21.1
σ	2	27.4
τ	1	39.4
υ	1	55.3
φ¹	0	39.2
φ²	0	45.1
φ³	0	51.0
φ⁴	0	53.7
χ	1	44.7
R	2	20.9
S	0	19.0
T	0	16.7
U	2	28.9
V	23	52.8
W	23	57.0
X	3	14.4
Y	23	54.4
Z	1	1.6
RR	1	27.0
RS	2	22.9

Chamaeleon
Chamaeleontis

Cha Cham
−75° to −83°

	h	m
α	8	21.1
β	12	12.5
γ	10	34.3
δ	10	44.8
ε	11	54.7
ζ	9	36.8
η	8	44.7
θ	8	23.6
ι	9	27.5
κ	11	59.6
μ	10	3.4
ν	9	46.3

Chamaeleon (Continued)

	h	m
π	11	33.1
R	8	24.0
S	13	24.6
T	11	52.4
U	13	36.3

Circinus
Circini

Cir Circ
−55° to −70°

	h	m
α	14	34.4
β	15	9.7
γ	15	15.4
δ	15	8.9
ε	15	9.2
ζ	14	46.2
η	14	56.4
θ	14	48.7
R	15	20.0
S	15	21.4
T	13	36.2
U	13	58.0
N 1	14	40.5

Columba
Columbae

Col Colm
−27° to −43°

	h	m
α	5	36.0
β	5	47.4
γ	5	54.0
δ	6	18.5
ε	5	27.7
η	5	56.1
θ	6	4.1
κ	6	13.0
λ	5	49.5
μ	5	42.3
ν¹	5	33.3
ν²	5	33.8
ξ	5	52.1
ο	5	13.9
π¹	6	3.6
π²	6	4.8
σ	5	52.6
R	5	46.7
S	5	43.2
T	5	15.6
U	6	11.2
V	6	6.4
W	6	24.6
X	5	22.1

Coma
Berenices
Comae
Berenices

Com Coma
+14° to +31°

	h	m
α	13	5.1
β	13	7.2
γ	12	22.0
R	11	59.1
S	12	27.8
T	12	53.7
U	12	35.1
V	12	5.2
W	12	16.5
X	12	55.6
Y	13	1.7
Z	13	3.4
RR	13	5.7
RS	13	9.8
RT	13	12.0
RU	13	12.0
RV	13	13.0

Corona
Austrina
Coronae
Austrinae

CrA CorA
−37° to −46°

	h	m
α	19	2.7
β	19	3.2
γ	18	59.7
δ	19	1.4
ε	18	52.0
ζ	18	56.0
η¹	18	41.6
η²	18	42.4
θ	18	26.4
κ	18	26.5
λ	18	36.9
μ	18	40.8
R	18	55.2
S	18	54.4
T	18	55.2
U	18	34.3
V	18	40.7
W	17	58.2
X	18	2.6
Y	18	7.2
Z	18	23.8
RR	17	59.0
RS	18	56.3
RT	18	38.7
RU	19	10.5
RV	18	33.0

Corona Aus. (Continued)

	h	m
RW	17	52.5
RX	18	19.2
RY	18	14.6
RZ	19	1.6
SS	18	0.3

Corona
Borealis
Coronae
Borealis

CrB CorB
+25° to +41°

	h	m
α	15	30.5
β	15	23.7
γ	15	38.5
δ	15	45.4
ε	15	53.4
ζ	15	35.6
η	15	19.1
θ	15	28.9
ι	15	57.4
κ	15	47.5
λ	15	52.2
μ	15	31.6
ν	16	18.6
ξ	16	18.2
ο	15	16.0
π	15	40.1
ρ	15	57.2
σ	16	10.9
τ	16	5.3
υ	16	12.7
R	15	44.4
S	15	17.3
T	15	55.3
U	15	14.1
V	15	46.0
W	16	11.8
X	15	45.2
Y	15	43.1
Z	15	52.1
RR	15	37.8
RS	15	54.8
RT	15	34.0
RU	15	31.4
RV	16	15.5
RW	15	35.2
RX	15	13.6
RY	16	19.2

Corvus
Corvi

Crv Corv
−11° to −25°

	h	m
α	12	3.3
β	12	29.1
γ	12	10.7
δ	12	24.7
ε	12	5.0
ζ	12	15.4
η	12	26.9
R	12	14.4
S	12	32.4

Crater
Crateris

Crt Crat
− 6° to −25°

	h	m
α	10	54.9
β	11	6.7
γ	11	19.9
δ	11	14.3
ε	11	19.6
ζ	11	39.7
η	11	50.9
θ	11	31.6
ι	11	33.6
κ	11	22.1
λ	11	18.4
R	not var	
S	11	47.6
T	11	18.9

Crux
Crucis

Cru Cruc
−55° to −65°

	h	m
α	12	21.0
β	12	41.9
γ	12	25.6
δ	12	9.8
ε	12	16.0
ζ	12	13.0
η	12	1.7
θ¹	11	57.9
θ²	11	59.2
ι	12	39.8
κ	12	47.8
λ	12	48.7
μ	12	48.7
R	12	18.1
S	12	48.4
T	12	15.9
U	12	26.8

Crux (Continued)

	h	m
V	12	50.6
W	12	6.7
X	12	40.6
Y	11	57.8
Z	12	5.9
RR	12	18.0
RS	12	20.4
RT	12	29.1
RU	12	32.8
RV	12	12.3
RW	12	34.3
RX	12	43.6
RY	12	48.4
RZ	12	51.2
SS	12	4.9
ST	12	20.2

Cygnus
Cygni
Cyg Cygn
+27° to +61°

	h	m
α	20	38.0
β	19	26.7
γ	20	18.6
δ	19	41.8
ε	20	42.2
ζ	21	8.7
η	19	52.6
θ	19	33.8
ι	19	27.2
κ	19	14.8
λ	20	43.5
μ	21	39.7
ν	20	53.4
ξ	21	1.3
o^1	20	10.4
o^2	20	12.4
π^1	21	38.5
π^2	21	43.1
ρ	21	30.2
σ	21	13.5
τ	21	10.8
υ	21	13.8
φ	19	35.4
χ	19	46.7
ψ	19	53.0
ω^1	20	27.0
ω^2	20	28.2
R	19	34.1
S	20	3.4
T	not	var
U	20	16.5
V	20	38.1
W	21	32.2

Cygnus (Continued)

	h	m
X	20	39.5
Y	20	48.1
Z	19	58.6
RR	20	42.6
RS	20	9.8
RT	19	40.8
RU	21	37.3
RV	21	39.1
RW	20	25.2
RX	not	var
RY	20	6.6
RZ	20	48.5
SS	21	38.8
ST	20	29.9
SU	19	40.8
SV	20	6.5
SW	20	3.8
SX	20	11.6
SY	19	42.7
SZ	20	29.6
TT	19	37.1
TU	19	43.4
TV	20	30.0
TW	21	1.7
TX	20	56.4
TY	19	29.8
TZ	19	13.5
UU	21	35.6
UV	19	28.0
UW	20	19.6
UX	20	50.9
UY	20	52.3
UZ	21	55.2
VV	21	2.3
VW	20	11.4
VX	20	53.6
VY	21	0.4
VZ	21	47.7
WW	20	0.6
WX	20	14.8
WY	21	44.8
WZ	20	49.3
XX	20	1.3
XY	19	45.3
XZ	19	30.4
YY	21	18.6
YZ	20	58.9
ZZ	20	20.7
AA	20	0.8
AB	21	32.2
AC	20	9.9
AD	20	27.6
AE	21	9.0
AF	19	27.2
AG	19	49.9
AH	19	57.1
AI	20	27.8
AK	21	40.6
AL	20	43.1
AM	20	44.9

Cygnus (Continued)

	h	m
AN	20	47.4
AO	20	47.7
AP	20	50.3
AQ	20	52.1
AR	20	52.1
AS	20	53.0
AT	20	53.1
AU	20	14.7
AV	19	16.8
AW	19	25.8
AX	19	54.0
AY	20	6.3
AZ	20	54.5
BB	21	23.1
BC	20	17.9
BD	20	43.5
BE	20	59.3
BF	19	20.0
BG	19	34.9
BH	21	15.2
BI	20	17.6
BK	21	26.9
BL	21	27.3
BM	21	28.3
BN	21	41.0
BO	21	45.2
BP	21	49.1
BQ	21	51.2
BR	19	38.0
BS	19	49.2
BT	19	57.4
BU	20	2.6
BV	20	30.0
BW	20	32.1
BX	20	32.7
BY	20	33.5
BZ	20	42.5
CC	20	45.0
CD	20	0.6
CE	21	15.4
CF	19	58.8
CG	20	54.2
P	20	14.1
Q	21	37.8
N 1	19	55.9

Delphinus
Delphini
Del Delf
+ 5° to +20°

	h	m
α	20	35.0
β	20	32.9
γ	20	42.0
δ	20	38.8

Delphinus (Continued)

	h	m
ε	20	28.4
ζ	20	30.6
η	20	29.2
θ	20	34.0
ι	20	33.0
κ	20	34.3
R	20	10.1
S	20	38.5
T	20	40.7
U	20	40.9
V	20	43.2
W	20	33.1
X	20	50.3
Y	20	36.9
Z	20	28.1
RR	20	38.9
RS	20	24.6
RT	20	24.6

Dorado
Doradus
Dor Dora
−51° to −70°

	h	m
α	4	31.8
β	5	32.8
γ	4	13.4
δ	5	44.6
ε	5	50.0
ζ	5	3.8
η^1	6	6.0
η^2	6	11.0
θ	5	13.8
κ	4	42.9
λ	5	24.8
ν	6	9.4
π^1	6	23.6
π^2	6	26.3
R	4	35.6
S	5	18.9
T	4	44.0
U	5	9.6
V	4	57.3
W	5	30.3
X	5	34.9
Y	5	35.4
Z	5	39.3
RR	5	40.8
RS	5	41.3

Draco
Draconis
Dra Drac
+48° to +83°

	h	m
α	14	1.7
β	17	28.2
γ	17	54.3
δ	19	12.5
ε	19	48.5
ζ	17	8.5
η	16	22.6
θ	16	0.0
ι	15	22.7
κ	12	29.2
λ	11	25.5
μ	17	3.3
ν	17	30.2
ξ	17	51.8
o	18	49.7
π	19	20.2
ρ	20	2.4
σ	19	32.6
τ	19	17.5
υ	18	55.6
φ	18	22.2
χ	18	22.9
ψ	17	43.7
ω	17	37.5
R	16	32.4
S	16	40.8
T	17	54.9
U	19	10.0
V	17	56.3
W	18	5.4
X	18	6.8
Y	9	31.1
Z	11	39.8
RR	18	40.9
RS	18	40.2
RT	18	21.4
RU	18	18.0
RV	12	33.2
RW	16	33.7
RX	19	1.1
RY	12	52.5
RZ	18	21.6
SS	12	21.8
ST	16	33.8
SU	11	32.2
SV	18	31.1
SW	12	13.1
SX	18	3.1
SY	17	32.1
SZ	19	9.7
TT	17	11.2
TU	18	48.9
TV	17	7.8
TW	15	32.4
TX	16	33.6
TY	17	35.4
TZ	18	19.5
UU	20	25.7

Draco (Continued)

	h	m
UV	14	41.1
UW	17	55.5
UX	19	25.1
UY	17	54.8
UZ	19	26.1
VV	12	12.8
VW	17	15.3
VX	15	32.8
VY	15	38.6
VZ	16	19.5

Equuleus
Equulei
Equ Equl
+ 1° to +11°

α	21	10.8
β	21	17.9
γ	21	5.5
δ	21	9.6
R	21	8.4
S	20	52.2
T	21	10.9

Eridanus
Eridani
Eri Erid
+ 2° to −58°

α	1	34.0
β	5	2.9
γ	3	53.4
δ	3	38.5
ε	3	28.2
ζ	3	11.0
η	2	51.5
θ	2	54.5
ι	2	36.7
κ	2	23.3
λ	5	4.4
μ	4	40.5
ν	4	31.3
ξ	4	18.7
o^1	4	7.0
o^2	4	10.7
π	3	41.4
ρ^1	2	56.2
ρ^2	2	57.8
ρ^3	2	59.4
τ^1	2	40.4
τ^2	2	46.5
τ^3	2	58.0
τ^4	3	15.1
τ^5	3	29.4

Eridanus (Continued)

	h	m
τ^6	3	42.5
τ^7	3	43.4
τ^8	3	49.4
τ^9	3	55.7
υ^1	4	29.6
υ^2	4	31.7
φ	2	12.9
χ	1	52.1
ψ	4	56.6
ω	4	48.0
R	not var	
S	not var	
T	3	51.0
U	3	46.2
V	3	59.7
W	4	7.3
X	2	27.4
Y	2	2.2
Z	2	43.1
RR	2	47.3
RS	4	13.5
RT	3	29.6
RU	3	50.1
RV	4	2.0
RW	4	17.7
RX	4	45.2
RY	3	54.4
RZ	4	39.0
SS	3	7.0

Fornax
Fornacis
For Forn
−24° to −40°

α	3	7.8
β	2	44.9
γ^1	2	45.4
γ^2	2	45.6
δ	3	38.3
ε	2	57.3
ζ	2	55.2
η^1	2	43.5
η^2	2	46.2
η^3	2	46.6
ι^1	2	31.8
ι^2	2	34.0
κ	2	18.0
λ^1	2	28.9
λ^2	2	32.8
μ	2	8.5
ν	2	0.0
π	1	56.8
ρ	3	43.9
σ	3	42.4
τ	3	34.6
φ	2	23.8

Fornax (Continued)

	h	m
χ^1	3	22.1
χ^2	3	23.7
χ^3	3	24.3
ψ	2	49.6
ω	2	29.4
R	2	24.8
S	3	41.9
T	3	25.4
U	3	40.1

Gemini
Geminorum
Gem Gemi
+11° to +37°

α	7	28.2
β	7	39.2
γ	6	31.9
δ	7	14.2
ε	6	37.8
ζ	6	58.2
η	6	8.8
θ	6	46.2
ι	7	19.5
κ	7	38.4
λ	7	12.3
μ	6	16.9
ν	6	23.0
ξ	6	39.7
o	7	32.6
π	7	41.1
ρ	7	22.7
σ	7	37.1
τ	7	4.8
υ	7	29.8
φ	7	47.4
χ	7	57.4
ψ	8	6.9
ω	6	56.3
R	7	1.3
S	7	37.0
T	7	43.3
U	7	49.2
V	7	17.6
W	6	29.2
X	6	40.7
Y	7	35.3
Z	7	1.6
RR	7	15.2
RS	6	55.2
RT	6	40.7
RU	7	21.0
RV	7	11.9
RW	5	55.4
RX	6	43.6
RY	7	21.7
RZ	5	56.6

Gemini (Continued)

	h	m
SS	6	2.5
ST	7	32.7
SU	6	7.7
SV	5	54.6
SW	6	53.3
SX	6	22.0
SY	6	34.2
SZ	7	48.0
TT	6	19.8
TU	6	4.7
TV	6	5.8
TW	7	1.3
TX	7	30.3
TY	6	24.2
TZ	6	31.7
UU	6	31.8
UV	6	32.9
UW	6	36.6
UX	6	40.3
UY	6	40.3
UZ	7	7.1
VV	6	19.8
VW	6	35.7
VX	7	7.1
VY	7	42.8
VZ	8	1.5
WW	6	6.0
WX	6	38.8
WY	6	5.8
N 1	6	37.8
N 2	6	48.4

Grus
Gruis
Gru Grus
−37° to −55°

α	22	1.9
β	22	36.7
γ	21	47.9
δ^1	22	23.3
δ^2	22	23.8
ε	22	42.5
ζ	22	55.0
η	22	39.5
θ	23	1.2
ι	23	4.7
κ	22	58.7
λ	22	0.1
μ^1	22	9.6
μ^2	22	10.4
ν	22	22.8
ξ	21	25.8
o	23	21.0
π	22	17.0
ρ	22	37.7
τ^1	22	47.7

Grus (Continued)

	h	m
τ^2	22	49.4
τ^3	22	51.0
υ	23	1.3
φ	23	12.6
R	21	42.1
S	22	19.9
T	22	19.8
U	21	25.3
V	21	45.7
W	22	35.4
X	23	14.0

Hercules
Herculis
Her Herc
+ 4° to +51°

α	17	10.0
β	16	25.9
γ	16	17.5
δ	17	10.9
ε	16	56.5
ζ	16	37.5
η	16	39.5
θ	17	52.8
ι	17	36.6
κ	16	3.6
λ	17	26.7
μ	17	42.5
ν	17	54.7
ξ	17	53.9
o	18	3.6
π	17	11.6
ρ	17	20.2
σ	16	30.9
τ	16	16.7
υ	15	59.7
φ	16	5.6
χ	15	49.2
ω	16	20.8
R	16	1.7
S	16	47.4
T	18	5.3
U	16	21.4
V	not var	
W	16	31.7
X	15	59.6
Y	not var	
Z	17	53.6
RR	16	1.5
RS	17	17.5
RT	17	6.8
RU	16	6.0
RV	16	56.7
RW	18	1.7
RX	18	26.0
RY	17	55.4

Hercules (Continued)

	h	m
RZ	18	32.7
SS	16	28.0
ST	15	47.8
SU	17	44.8
SV	18	22.3
SW	16	54.2
SX	16	3.2
SY	16	57.3
SZ	17	36.0
TT	16	49.9
TU	17	9.8
TV	18	10.9
TW	17	50.7
TX	17	15.4
TY	16	31.6
TZ	16	31.1
UU	16	32.5
UV	16	40.9
UW	17	10.9
UX	17	49.7
UY	16	29.7
UZ	17	25.9
VV	16	8.3
VW	18	2.6
VX	16	26.2
VY	17	2.8
VZ	17	9.5
WW	17	21.7
WX	17	22.7
WY	17	55.9
WZ	17	57.2
XX	17	58.2
XY	18	1.2
XZ	18	5.7
YY	18	10.3
YZ	18	13.9
ZZ	18	14.2
AA	18	15.5
AB	18	25.2
AC	18	26.0
AD	18	45.7
AE	18	39.0
AF	16	36.4
AG	16	37.2
g	16	25.4
u	17	13.6

Horologium
Horologii

Hor to Horo
−40° to −68°

	h	m
α	4	10.7
β	2	56.9
δ	4	7.5
ζ	2	37.5
η	2	34.1

Horologium (Continued)

	h	m
ι	2	39.1
λ	2	22.1
μ	3	1.3
ν	2	46.8
R	2	50.6
S	2	22.4
T	2	57.7
U	3	49.6
V	3	1.0
W	2	41.2
X	2	45.1
Y	2	33.4
Z	2	47.9
RR	3	37.5

Hydra
Hydrae

Hya to Hyda
+8° to −36°

	h	m
α	9	22.7
β	11	47.8
γ	13	13.5
δ	8	32.4
ϵ	8	41.5
ζ	8	50.1
η	8	38.0
θ	9	9.2
ι	9	34.7
κ	9	35.5
λ	10	5.7
μ	10	21.3
ν	10	44.7
ξ	11	28.1
o	11	35.2
π	14	0.7
ρ	8	43.1
σ	8	33.5
τ^1	9	24.1
τ^2	9	26.9
v^1	9	46.7
v^2	10	0.3
ϕ	10	33.7
χ	11	0.8
ψ	13	3.7
ω	9	0.7
R	13	24.2
S	8	48.4
T	8	50.8
U	10	32.6
V	10	46.8
W	13	43.4
X	9	30.7
Y	9	46.4
Z	11	42.6
RR	9	40.4

Hydra (Continued)

	h	m
RS	10	46.6
RT	8	24.8
RU	14	5.8
RV	8	34.9
RW	13	28.8
RX	9	0.8
RY	8	14.9
RZ	9	19.9
SS	13	25.0
ST	9	33.2
SU	9	49.1
SV	12	25.2
SW	12	57.9
SX	13	39.0
SY	8	25.1

Hydrus
Hydri

Hyi to Hydi
−58° to −81°

	h	m
α	1	55.6
β	0	20.5
γ	3	48.8
δ	2	20.0
ϵ	2	38.0
ζ	2	44.0
η^1	1	50.0
η^2	1	52.4
θ	3	2.0
ι	3	18.4
κ	2	22.3
λ	0	45.1
μ	2	33.8
ν	2	51.1
π^1	2	12.1
π^2	2	13.4
σ	1	56.0
τ^1	1	41.3
τ^2	1	48.7

Indus
Indi

Ind to Indi
−45° to −73°

	h	m
α	20	30.5
β	20	47.0
γ	21	19.1
δ	21	51.1
ϵ	21	55.7
ζ	20	42.6

Indus (Continued)

	h	m
η	20	36.7
θ	21	12.7
ι	20	44.3
μ	20	57.9
ν	22	16.0
o	21	42.3
ρ	22	47.7
R	22	28.9
S	20	49.0
T	21	13.6
U	20	35.0
V	21	4.8
W	21	7.2
X	21	23.4
Y	21	37.1
Z	21	47.8
RR	21	38.4
RS	21	27.9
RT	20	39.0

Lacerta
Lacertae

Lac to Lacr
+35° to +56°

	h	m
α	22	27.2
β	22	19.6
R	22	38.8
S	22	24.6
T	not var	
U	22	43.6
V	22	44.6
W	22	3.2
X	22	45.0
Y	22	5.2
Z	22	36.9
RR	22	37.5
RS	22	8.7
RT	21	57.4
RU	22	51.9
RV	22	40.4
RW	22	40.6
RX	22	45.4
RY	22	8.1
RZ	22	31.6
SS	22	0.7
ST	22	38.9
SU	22	19.2
SV	22	32.2
SW	22	49.0
SX	22	51.3
N 1	22	31.8

Leo
Leonis

Leo to Leon
+32° to −4°

	h	m
α	10	3.0
β	11	44.0
γ	10	14.5
δ	11	8.8
ϵ	9	40.2
ζ	10	11.1
η	10	1.9
θ	11	9.0
ι	11	18.7
κ	9	18.8
λ	9	26.0
μ	9	47.1
ν	9	52.8
ξ	9	26.6
o	9	35.8
π	9	54.9
ρ	10	27.5
σ	11	16.0
τ	11	22.8
υ	11	31.8
ϕ	11	11.6
χ	10	59.9
ψ	9	38.3
ω	9	23.1
R	9	42.2
S	11	5.7
T	not var	
U	10	18.7
V	9	54.5
W	10	48.3
X	9	45.6
Y	9	31.1
Z	9	**46.4**
RR	10	2.1
RS	9	37.8
RT	9	39.8
RU	10	47.7
RV	10	18.6
RW	10	34.4
RX	11	18.7
RY	9	58.9
RZ	11	32.2
SS	11	28.8
ST	11	33.4
SU	9	48.4
SV	9	**57.0**
SW	10	50.8

Leo Minor
Leonis Minoris
LMi LMin
+23° to +42°

	h m
β	10 22.1
R	9 39.6
S	9 47.8
T	9 42.5
U	9 48.6
V	10 19.8
W	10 39.2
X	10 0.1

Lepus
Leporis
Lep Leps
−11° to −28°

	h m
α	5 28.3
β	5 24.0
γ	5 40.3
δ	5 47.0
ε	5 1.2
ζ	5 42.4
η	5 51.9
θ	6 1.6
ι	5 7.6
κ	5 8.6
λ	5 15.0
μ	5 8.4
ν	5 15.3
R	4 55.0
S	6 1.6
T	5 0.6
U	4 52.0
V	6 6.7

Libra
Librae
Lib Libr
+ 1° to −30°

	h m
α	14 45.3
β	15 11.6
γ	15 29.9
δ	14 55.6
ε	15 18.8
ζ	15 27.3
η	15 38.4
θ	15 48.1
ι	15 6.5
κ	15 36.2
λ	15 47.5
μ	14 43.8
ν	15 1.0
ξ^1	14 49.0

Libra (Continued)

	h m
ξ^2	14 51.3
o	15 15.4
σ	14 58.2
τ	15 32.5
υ	15 31.0
R	15 47.9
S	15 15.6
T	15 5.0
U	15 36.2
V	14 34.8
W	15 32.2
X	15 30.4
Y	15 6.4
Z	15 40.7
RR	15 50.6
RS	15 18.5
RT	15 0.8
RU	15 27.7
RV	14 30.2
RW	15 17.2
RX	15 36.2
RY	14 21.8
RZ	14 54.2
SS	15 43.4
ST	15 40.9
SU	15 16.0
SV	15 27.4
SW	15 50.0
SX	14 37.1
SY	14 58.1
SZ	15 12.0
TT	15 3.4
TU	15 29.5

Lupus
Lupi
Lup Lupi
−29° to −55°

	h m
α	14 35.3
β	14 52.0
γ	15 28.5
δ	15 14.8
ε	15 15.9
ζ	15 5.1
η	15 53.5
θ	16 0.0
ι	14 13.0
κ	15 5.0
λ	15 2.1
μ	15 11.6
ν^1	15 15.2
ν^2	15 15.1
ξ	15 50.5
o	14 45.1
π	14 58.3
ρ	14 31.2

Lupus (Continued)

	h m
σ	14 25.9
τ^1	14 19.7
τ^2	14 19.7
υ	15 18.2
ϕ^1	15 15.5
ϕ^2	15 16.8
χ	15 44.6
ψ^1	15 33.4
ψ^2	15 36.3
ω	15 31.3
R	15 47.0
S	14 46.7
T	14 15.7
U	15 54.5
V	14 52.6
W	15 8.5
X	14 46.8
Y	14 52.3
Z	14 29.4
RR	15 58.6
RS	14 17.0
RT	14 24.1
RU	15 50.1
RV	14 18.5
RW	14 20.0
RX	15 39.6
RY	15 52.7

Lynx
Lyncis
Lyn Lync
+33° to +63°

	h m
α	9 15.0
R	6 53.0
S	6 35.9
T	8 16.4
U	6 31.8
V	6 20.5
W	8 10.1
X	8 19.1
Y	7 20.9
Z	8 0.6

Lyra
Lyrae
Lyr Lyra
+25° to +48°

	h m
α	18 33.6
β	18 46.4
γ	18 55.2
δ^1	18 50.2
δ^2	18 51.0

Lyra (Continued)

	h m
ε	18 41.0
ζ	18 41.3
η	19 10.4
θ	19 12.9
ι	19 3.7
κ	18 16.4
λ	18 56.2
μ	18 20.9
ν	18 46.0
R	18 52.3
S	19 9.1
T	18 28.9
U	19 16.6
V	19 5.2
W	18 11.5
X	19 9.0
Y	18 34.2
Z	18 56.0
RR	19 22.3
RS	19 9.3
RT	18 57.8
RU	19 9.1
RV	19 12.5
RW	18 42.1
RX	18 50.4
RY	18 41.2
RZ	18 39.9
SS	19 10.4
ST	19 6.7
SU	18 50.1
SV	18 42.0
SW	18 51.1
SX	18 51.2
SY	18 37.6
SZ	18 31.6
TT	19 24.3
TU	18 16.8
TV	18 18.0
TW	18 20.6
TX	18 13.2
TY	19 5.9
TZ	18 12.6
UU	19 1.7
UV	19 6.5
UW	19 7.6
UX	18 20.7
UY	18 50.8
UZ	19 17.6
VV	18 29.6
VW	18 32.6
VX	18 38.7
N 1	18 49.5

Mensa
Mensae
Men Mens
−71° to −85°

	h m
α	6 13.2
β	5 4.0
γ	5 35.8
δ	4 24.7
ε	7 31.2
ζ	6 48.4
η	4 58.1
θ	7 2.9
ι	5 41.7
κ	5 57.0
μ	4 44.1
ν	4 29.8
ξ	5 10.2
π	5 45.1
R	5 46.0
S	7 0.7

Microscopium
Microscopii
Mic Micr
−28° to −45°

	h m
α	20 43.7
β	20 45.8
γ	20 55.2
δ	21 0.0
ε	21 11.9
ζ	20 56.6
η	20 59.9
θ^1	21 14.4
θ^2	21 18.0
ι	20 41.7
ν	20 27.0
R	20 34.0
S	21 20.8
T	20 21.8
U	20 22.6
V	21 17.4
W	21 16.6
X	20 58.4
Y	21 0.9
Z	21 10.4

Monoceros
Monocerotis
Mon Mono
+13° to −12°

	h m
α	7 36.5
β	6 24.0
γ	6 10.0
δ	7 6.8

Monoceros (Continued)

	h	m
ϵ	6	18.5
ζ	8	3.6
R	6	33.7
S	not var	
T	6	19.8
U	7	26.0
V	6	17.7
W	6	47.5
X	6	52.4
Y	6	51.3
Z	6	28.0
RR	7	12.4
RS	7	2.2
RT	8	4.0
RU	6	49.4
RV	6	53.0
RW	6	29.3
RX	7	24.3
RY	7	2.1
RZ	6	33.1
SS	6	35.6
ST	6	41.7
SU	7	37.6
SV	6	16.1
SW	6	21.7
SX	6	46.6
SY	6	32.4
SZ	6	46.3
TT	7	20.8
TU	7	48.2
N 1	7	21.9

Musca
Muscae

Mus Musc
$-64°$ to $-75°$

	h	m
α	12	31.2
β	12	40.1
γ	12	26.5
δ	12	55.4
ϵ	12	12.2
ζ^1	12	16.6
ζ^2	12	16.6
η	13	8.5
θ	13	1.7
ι^1	13	17.2
ι^2	13	19.3
λ	11	40.9
μ	11	43.4
R	12	36.0
S	12	7.4
T	13	13.5
U	13	18.3
V	12	35.3
W	12	45.4
X	12	56.6

Musca (Continued)

	h	m
Y	12	59.4
Z	12	59.4
RR	11	35.0
RS	12	17.4
RT	11	39.8
RU	12	57.4

Norma
Normae

Nor Norm
$-42°$ to $-60°$

	h	m
γ^1	16	9.5
γ^2	16	12.4
δ	15	59.4
ϵ	16	19.8
η	15	55.9
θ	16	8.0
ι^1	15	55.4
ι^2	16	1.1
κ	16	5.6
λ	16	12.3
μ	16	27.0
R	15	28.8
S	16	10.6
T	15	36.4
U	15	34.6
V	16	2.6
W	16	9.0
X	16	17.8
Y	16	25.6
Z	15	57.8
RR	15	5.1
RS	15	57.4
RT	16	15.8
RU	16	8.2
RV	15	56.2
RW	15	58.0
RX	16	4.4
RY	16	23.6
RZ	16	24.8
N 1	15	22.2
N 2	15	32.0

Octans
Octantis

Oct Octn
$-75°$ to $-89°$

	h	m
α	20	52.6
β	22	35.8
γ^1	23	46.2
γ^2	23	52.1

Octans (Continued)

	h	m
γ^3	0	5.5
δ	14	10.9
ϵ	22	8.8
ζ	9	11.2
η	11	0.0
θ	23	56.5
ι	12	44.4
κ	13	24.7
λ	21	35.6
μ^1	20	29.7
μ^2	20	29.8
ν	21	30.4
ξ	22	41.1
π^1	14	44.2
π^2	14	47.3
ρ	15	20.2
σ	18	59.7
τ	23	13.2
υ	22	12.6
ϕ	18	10.2
χ	17	56.1
ψ	22	8.1
ω	14	49.3
R	5	56.4
S	17	24.0
T	20	57.4
U	13	12.3
V	21	58.8
W	10	4.4
X	10	29.6
Y	13	39.7
Z	17	3.8
RR	20	44.4
RS	21	5.2
RT	22	41.4
RU	0	4.7

Ophiuchus
Ophiuchi

Oph Ophi
$+17°$ to $-30°$

	h	m
α	17	30.3
β	17	38.5
γ	17	42.9
δ	16	9.1
ϵ	16	13.0
ζ	16	31.7
η	17	4.6
θ	17	15.9
ι	16	49.3
κ	16	52.9
λ	16	25.9
μ	17	32.4
ν	17	53.5
ξ	17	15.0

Ophiuchus (Continued)

	h	m
o	17	11.9
ρ	16	19.6
σ	17	21.6
τ	17	57.6
υ	16	22.4
ϕ	16	25.4
χ	16	21.2
ψ	16	18.3
ω	16	26.2
R	17	2.0
S	16	28.5
T	16	28.0
U	17	11.4
V	16	21.2
W	16	16.0
X	18	33.6
Y	17	47.3
Z	17	14.5
RR	16	43.2
RS	17	44.8
RT	17	51.8
RU	17	28.1
RV	17	29.8
RW	17	50.5
RX	16	47.9
RY	18	11.6
RZ	18	40.9
SS	16	52.6
ST	17	28.8
SU	17	34.4
SV	17	51.4
SW	16	11.1
SX	16	12.6
SY	16	49.1
SZ	17	9.6
TT	16	44.6
TU	16	20.7
TV	16	36.6
TW	17	23.8
TX	16	59.1
TY	18	26.4
TZ	16	23.2
UU	16	51.2
UV	16	37.2
UW	17	39.2
UX	16	59.4
UY	17	11.5
UZ	17	17.1
VV	17	21.8
VW	17	22.4
VX	17	23.1
VY	17	27.8
VZ	17	29.8
WW	17	50.9
WX	18	25.2
WY	18	36.8
WZ	17	1.9
XX	17	38.6
N 1	17	24.6
N 2	16	53.9

Ophiuchus (Continued)

	h	m
N 3 = RS		
N 4	18	9.4
N 5	16	48.4

Orion
Orionis

Ori Orio
$+21°$ to $-11°$

	h	m
α	5	49.8
β	5	9.7
γ	5	19.8
δ	5	26.9
ϵ	5	31.1
ζ	5	35.7
η	5	19.4
θ	5	30.4
ι	5	30.5
κ	5	43.0
λ	5	29.6
μ	5	56.9
ν	6	1.9
ξ	6	6.3
o^1	4	46.9
o^2	4	50.7
π^1	4	49.4
π^2	4	45.2
π^3	4	44.4
π^4	4	45.9
π^5	4	49.0
π^6	4	53.4
ρ	5	8.1
σ	5	33.7
τ	5	12.8
υ	5	27.1
ϕ^1	5	29.3
ϕ^2	5	31.4
χ^1	5	48.5
χ^2	5	58.0
ψ	5	21.6
ω	5	33.9
R	4	53.6
S	5	24.1
T	5	30.9
U	5	49.9
V	5	0.8
W	5	0.2
X	5	32.6
Y	5	36.6
Z	5	50.2
RR	5	57.3
RS	6	16.5
RT	5	27.8
RU	5	34.0
RV	5	34.6
RW	5	34.7
RX	5	24.0

Orion (Continued)	h m
RY	5 27.2
RZ	5 28.6
SS	5 28.8
ST	5 28.9
SU	5 29.0
SV	5 29.1
SW	5 29.4
SX	5 29.9
SY	5 30.2
SZ	5 30.2
TT	5 30.3
TU	5 30.4
TV	5 30.7
TW	5 30.6
TX	5 33.5
TY	5 33.6
TZ	5 34.8
UU	5 36.0
UV	5 49.1
UW	5 49.9
UX	4 59.5
UY	5 27.1
UZ	5 27.9
VV	5 28.4
VW	5 28.4
VX	5 28.6
VY	5 28.7
VZ	5 28.8
WW	5 29.2
WX	5 29.2
WY	5 29.2
WZ	5 29.5
XX	5 29.7
XY	5 29.8
XZ	5 29.8
YY	5 29.9
YZ	5 30.0
ZZ	5 30.0
AA	5 30.3
AB	5 30.3
AC	5 30.4
AD	5 30.4
AE	5 30.4
AF	5 30.4
AG	5 30.4
AH	5 30.5
AI	5 30.5
AK	5 30.5
AL	5 30.6
AM	5 30.7
AN	5 30.8
AO	5 30.8
AP	5 30.8
AQ	5 31.0
AR	5 31.0
AS	5 31.0
AT	5 31.0
AU	5 31.1
AV	5 31.1
AW	5 31.2

Orion (Continued)	h m
AX	5 31.2
AY	5 31.3
AZ	5 31.4
BB	5 31.5
BC	5 31.7
BD	5 31.8
BE	5 32.2
BF	5 32.4
BG	5 34.4
BH	5 35.2
BI	5 18.7
BK	5 26.5
BL	6 19.8
BM	5 30.4
BN	5 31.1
BO	5 30.7
BP	5 32.5
BQ	5 51.0
N 1	5 16.4

Pavo Pavonis

Pav	Pavo
−56° to −75°	
α	20 17.7
β	20 36.0
γ	21 18.2
δ	19 58.9
ϵ	19 49.0
ζ	18 31.4
η	17 35.9
θ	18 38.8
ι	18 1.2
κ	18 46.6
λ	18 43.0
μ	19 51.4
ν	18 22.0
ξ	18 14.0
o	21 4.0
π	17 59.0
ρ	20 29.2
σ	20 39.8
τ	19 5.8
υ	20 32.8
ϕ^1	20 27.3
ϕ^2	20 31.8
ω	18 49.7
R	18 3.3
S	19 46.8
T	19 39.5
U	20 47.2
V	17 34.7
W	17 41.1
X	20 3.4
Y	21 15.2
Z	19 26.3

Pavo (Continued)	h m
RR	19 57.7
RS	17 58.5
RT	18 25.4
RU	17 58.5
RV	18 0.6
RW	18 46.2
RX	18 49.6
RY	19 53.2
RZ	17 40.1
SS	19 2.6
ST	20 55.5
x	18 46.6

Pegasus Pegasi

Peg	Pegs
+1° to +36°	
α	22 59.8
β	22 58.9
γ	0 8.1
ϵ	21 39.3
ζ	22 36.5
η	22 38.3
θ	22 5.2
ι	22 2.4
κ	21 40.1
λ	22 41.7
μ	22 45.2
ν	22 0.6
ξ	22 41.7
o	22 37.1
π	22 5.5
ρ	22 50.2
σ	22 47.3
τ	23 15.7
υ	23 20.4
ϕ	23 47.4
χ	0 9.4
ψ	23 52.7
R	23 1.6
S	23 15.5
T	22 4.0
U	23 52.9
V	21 56.0
W	23 14.9
X	21 16.2
Y	22 6.8
Z	23 55.0
RR	21 40.0
RS	22 7.4
RT	21 59.8
RU	22 9.2
RV	22 21.0
RW	22 59.2
RX	21 51.7
RY	22 1.4

Pegasus (Continued)	h m
RZ	22 1.5
SS	22 29.2
ST	22 44.3
SU	23 32.0
SV	22 1.4
SW	21 17.9
SX	22 45.5
SY	22 1.4
SZ	22 2.1
TT	0 1.4
TU	21 40.2
TV	21 22.1
TW	21 59.4
TX	22 13.4
TY	23 24.9
TZ	21 4.2
UU	21 26.2
UV	21 59.8
UW	22 13.1
UX	22 23.8
UY	22 40.0
UZ	21 45.1
VV	22 8.3
VW	22 51.7
VX	21 38.1
VY	21 57.5
VZ	23 37.2
WW	21 52.3
WX	21 55.5
WY	21 56.4
WZ	21 57.3
XX	22 1.7
XY	22 3.4
XZ	22 4.2
YY	22 13.9
YZ	22 15.8
ZZ	22 53.7

Perseus Persei

Per	Pers
+30° to +58°	
α	3 17.2
β	3 1.7
γ	2 57.6
δ	3 35.8
ϵ	3 51.1
ζ	3 47.8
η	2 43.4
θ	2 37.4
ι	3 1.8
κ	3 2.7
λ	3 59.1
μ	4 7.6
ν	3 38.4
ξ	3 52.5

Perseus (Continued)	h m
o	3 38.0
π	2 52.4
ρ	2 58.8
σ	3 23.5
τ	2 47.2
υ	1 31.9
ϕ	1 37.4
χ	2 15.1
ψ	3 29.4
ω	3 4.8
R	3 23.7
S	2 15.7
T	2 12.2
U	1 52.9
V	1 55.1
W	2 43.2
X	3 49.1
Y	3 20.9
Z	2 33.7
RR	2 21.7
RS	2 15.3
RT	3 16.8
RU	3 23.9
RV	4 4.2
RW	4 13.3
RX	3 45.0
RY	2 39.0
RZ	1 23.6
SS	1 49.6
ST	2 53.7
SU	2 15.1
SV	4 42.8
SW	4 4.0
SX	4 10.2
SY	4 9.0
SZ	3 40.7
TT	1 44.0
TU	3 1.8
TV	2 37.6
TW	3 13.7
TX	2 41.8
TY	1 55.8
TZ	2 6.8
UU	3 39.6
UV	2 3.3
UW	2 5.4
UX	2 6.1
UY	2 27.0
UZ	3 13.9
VV	3 19.7
VW	3 22.4
VX	2 0.8
VY	2 20
VZ	2 31.6
WW	3 11.8
WX	3 30.6
WY	3 31.6
WZ	3 34.8
XX	1 56.4
XY	3 43.0

Perseus (Continued)

	h	m
XZ	4	2.3
YY	4	29.3
YZ	2	31.2
ZZ	2	44.3
N 1 = V		
N 2	3	24.4

Phoenix
Phoenicis

Phe Phoe
−40° to −59°

	h	m
α	0	21.3
β	1	1.6
γ	1	24.0
δ	1	27.1
ε	0	4.3
ζ	1	4.2
η	0	38.9
ι	23	29.7
κ	0	21.3
λ¹	0	26.6
λ²	0	30.9
μ	0	36.6
ν	1	10.7
ξ	0	37.2
π	23	53.7
ρ	0	46.1
σ	23	42.0
τ	23	55.9
υ	1	3.2
φ	1	50.2
χ	1	57.7
ψ	1	49.6
R	23	51.3
S	23	53.9
T	0	25.6
U	0	30.3
V	23	27.0
W	1	15.8
X	1	19.4
Y	23	34.2
Z	23	53.9
RR	22	53.7

Pictor
Pictoris

Pic Pict
−44° to −64°

	h	m
α	6	47.2
β	5	44.9
γ	5	48.0
δ	6	8.3

Pictor (Continued)

	h	m
ζ	5	16.9
η¹	5	0.2
η²	5	2.4
θ	5	22.5
ι	4	48.7
λ	4	40.2
μ	6	30.5
ν	6	21.2
R	4	43.5
S	5	8.3
T	5	12.3
U	4	47.6
V	6	12.0
W	5	40.4
X	5	2.7
Y	5	8.3
Z	5	32.2

Pisces
Piscium

Psc Pisc
+31° to − 7°

	h	m
α	1	56.9
β	22	58.8
γ	23	12.0
δ	0	43.5
ε	0	57.8
ζ	1	8.5
η	1	26.1
θ	23	22.9
ι	23	34.8
κ	23	21.8
λ	23	36.9
μ	1	24.9
ν	1	36.2
ξ	1	48.4
ο	1	40.1
π	1	31.8
ρ	1	21.1
σ	0	57.3
τ	1	6.2
υ	1	14.0
φ	1	8.3
χ	1	6.1
ψ¹	1	0.3
ψ²	1	2.6
ψ³	1	4.5
ω	23	54.2
R	1	25.5
S	1	12.4
T	0	26.8
U	1	17.7
V	0	17.2
W	0	54.4
X	1	6.7
Y	23	29.3

Pisces (Continued)

	h	m
Z	1	10.6
RR	23	55.9
N 1	0	29.8

Piscis Austrinus
Piscis Austrini

PsA PscA
−25° to −37°

	h	m
α	22	52.1
β	22	25.8
γ	22	47.0
δ	22	50.4
ε	22	35.1
ζ	22	25.3
η	21	55.1
θ	21	41.9
ι	21	39.0
λ	22	8.6
μ	22	2.5
π	22	58.0
τ	22	4.3
υ	22	2.6
R	22	12.3
S	21	58.0
T	22	20.5
U	21	56.8
V	22	49.8
W	22	2.1

Puppis
Puppis

Pup Pupp
−11° to −51°

	h	m
ζ	8	0.1
ν	6	34.7
ξ	7	45.1
ο	7	43.9
π	7	13.6
ρ	8	3.3
σ	7	26.1
τ	6	47.5
R	not var	
S	not var	
T	not var	
U	7	56.2
V	7	55.4
W	7	42.6
X	7	28.4
Y	8	8.8
Z	7	28.3

Puppis (Continued)

	h	m
RR	7	43.5
RS	8	9.2
RT	8	1.8
RU	8	3.2
RV	6	39.4
RW	6	6.7
RX	8	10.7
RY	7	27.4
RZ	7	41.7
SS	7	42.5
ST	6	45.5
SU	7	53.0
SV	8	12.6
SW	8	15.4
L_2	7	10.5
N 1	8	9.6

Pyxis
Pyxidis

Pyx Pyxi
−19° to −37°

	h	m
α	8	39.6
β	8	36.2
γ	8	46.3
δ	8	51.2
ε	9	5.7
ζ	8	35.6
η	8	33.6
θ	9	17.1
κ	9	3.7
λ	9	18.9
R	8	41.3
S	9	0.7
T	9	0.5
U	8	25.8
V	8	49.4

Reticulum
Reticuli

Ret Reti
−54° to −68°

	h	m
α	4	13.1
β	3	42.9
γ	3	59.5
δ	3	57.2
ε	4	14.7
ζ	3	15.8
η	4	20.8
ι	3	59.7
κ	3	27.6
R	4	32.5
S	4	31.6

Sagitta
Sagittae

Sge Sgte
+16° to +22°

	h	m
α	19	35.6
β	19	36.6
γ	19	54.3
δ	19	42.9
ε	19	32.8
ζ	19	44.5
η	20	0.7
θ	20	5.5
R	20	9.5
S	19	51.5
T	19	17.2
U	19	14.4
V	20	15.8
W	19	15.1
X	20	0.7
Y	19	49.0
Z	19	49.5
RR	19	52.4
RS	19	52.7
RT	20	2.7
RU	19	46.1
RV	19	47.4
RW	19	48.1
RX	19	52.5
RY	19	53.9
RZ	19	58.8
N 1	19	28.3
N 2	20	3.1
N 3	20	3.0

Sagittarius
Sagittarii

Sgr Sgtr
−12° to −46°

	h	m
α	19	17.0
β¹	19	15.5
β²	19	16.0
γ	17	59.4
δ	18	14.6
ε	18	17.5
ζ	18	56.2
η	18	10.9
θ¹	19	53.2
θ²	19	53.4
ι	19	48.4
κ¹	20	15.7
κ²	20	17.1
λ	18	21.8
μ	18	7.8
ν	18	48.6
ξ¹	18	51.4
ξ²	18	51.8
ο	18	58.7
π	19	3.8

Sagittarius (Continued)	h m
ρ^1	19 15.9
ρ^2	19 16.0
σ	18 49.1
τ	19 0.7
υ	19 16.0
ϕ	18 39.4
χ^1	19 19.2
χ^2	19 19.4
ψ	19 9.4
ω	19 49.7
R	19 10.8
S	19 13.6
T	19 10.5
U	18 26.0
V	not var
W	17 58.6
X	17 41.3
Y	18 15.5
Z	19 13.8
RR	19 49.7
RS	18 11.0
RT	20 11.1
RU	19 51.8
RV	18 21.4
RW	19 8.1
RX	19 8.7
RY	19 10.0
RZ	20 8.5
SS	18 24.6
ST	18 55.9
SU	18 57.7
SV	17 57.2
SW	19 13.4
SX	18 39.7
SY	18 4.8
SZ	17 39.1
TT	19 19.7
TU	19 19.6
TV	19 37.3
TW	19 7.5
TX	19 8.2
TY	19 11.6
TZ	19 13.2
UU	19 17.8
UV	19 22.7
UW	19 40.6
UX	18 49.1
UY	17 46.0
UZ	17 47.1
VV	17 51.1
VW	17 54.4
VX	18 2.0
VY	18 6.1
VZ	18 8.7
WW	18 16.8
WX	17 53.6
WY	17 54.9
WZ	18 11.1
XX	18 19.0
XY	18 5.3

Sagittarius (Continued)	h m
XZ	18 16.0
YY	18 38.7
YZ	18 43.7
ZZ	18 43.0
AA	18 53.6
AB	18 56.3
AC	18 56.5
AD	18 58.3
AE	18 59.9
AF	19 1.0
AG	19 1.3
AH	19 3.4
AI	18 10.7
AK	18 22.3
AL	19 11.9
AM	19 16.3
AN	19 21.2
AO	18 5.8
AP	18 7.0
AQ	19 28.6
AR	18 53.6
AS	17 49.1
AT	17 57.3
AU	17 58.4
AV	17 58.8
AW	18 2.4
AX	18 2.6
AY	18 17.4
AZ	18 17.8
BB	18 45.1
BC	18 54.0
BD	18 57.6
BE	18 59.1
BF	18 59.4
BG	19 3.9
BH	19 8.6
BI	19 44.8
BK	19 43.9
BL	19 22.7
BM	19 31.9
BN	17 40.8
BO	19 34.5
BP	19 40.3
BQ	19 7.6
N 1	18 56.2
N 2	17 53.8
N 3	18 13.8
N 4	18 0.4
N 5	18 25.7
N 6	18 2.5
N 7	17 59.7

Scorpius Scorpii Sco — 8° to	Scor —45° h m
α	16 23.3
β	15 59.6
δ	15 54.4
ϵ	16 43.7
ζ	16 47.5
η	17 5.0
θ	17 30.1
ι^1	17 40.6
ι^2	17 43.2
κ	17 35.6
λ	17 26.8
μ	16 45.4
ν	16 6.2
ξ	15 58.9
o	16 14.6
π	15 52.8
ρ	15 50.7
σ	16 15.1
τ	16 29.7
υ	17 24.0
χ	16 8.3
ψ	16 6.5
ω^1	16 1.0
ω^2	16 1.5
R	16 11.7
S	16 11.7
T	16 11.1
U	16 16.8
V	not var
W	16 5.9
X	16 2.6
Y	16 23.6
Z	16 0.1
RR	16 50.2
RS	16 48.4
RT	16 56.8
RU	17 35.2
RV	16 51.8
RW	17 8.3
RX	16 5.9
RY	17 44.3
RZ	15 58.6
SS	16 48.8
ST	16 30.2
SU	16 34.2
SV	17 41.6
SW	17 18.1
SX	17 40.8
SY	17 47.2
SZ	16 49.6
TT	17 33.4
TU	17 1.1
TV	17 36.2
TW	16 4.9
TX	17 48.6
TY	15 57.6
TZ	16 1.8
UU	16 1.9

Scorpius (Continued)	h m
UV	16 2.6
UW	16 4.3
UX	16 4.4
UY	16 8.8
UZ	16 9.6
VV	16 9.6
VW	16 12.2
VX	16 12.4
VY	16 13.5
VZ	16 13.7
WW	16 21.0
WX	16 26.7
WY	16 27.2
WZ	16 27.6
XX	16 29.1
XY	16 30.7
XZ	16 30.9
YY	16 32.0
YZ	16 32.6
ZZ	16 34.8
AA	16 38.7
AB	16 39.5
AC	16 40.4
AD	16 43.1
AE	16 43.9
AF	16 44.3
AG	16 46.3
AH	17 4.8
AI	17 49.7
AK	16 48.0
AL	16 41.7
AM	16 1.2
AN	16 6.1
AO	16 9.1
AP	16 10.2
AQ	16 14.6
AR	16 15.8
AS	16 16.7
AT	16 25.5
AU	16 28.0
AV	16 31.2
AW	16 31.5
AX	16 35.6
AY	16 38.3
AZ	16 39.0
BB	16 39.7
BC	16 40.4
BD	16 40.5
BE	16 41.1
BF	16 42.2
BG	16 43.6
BH	16 44.1
BI	16 44.6
BK	15 53.5
BL	17 17.2
BM	17 34.4
BN	17 47.5
N 1	17 47.5
N 2	17 41.7

Sculptor Sculptoris Scl —25° to	Scul —40° h m
α	0 53.8
β	23 27.6
γ	23 13.4
δ	23 43.7
ϵ	1 41.0
ζ	23 57.2
η	0 23.0
θ	0 6.6
ι	0 16.5
κ^1	0 4.3
κ^2	0 6.5
λ^1	0 37.9
λ^2	0 39.4
μ	23 35.4
ξ	0 56.6
π	1 37.6
σ	0 57.7
τ	1 31.5
R	1 22.4
S	0 10.3
T	0 24.3
U	1 6.8
V	0 3.6
W	0 28.2
X	0 44.7
Y	23 3.7
Z	0 35.0
RR	0 24.5
RS	1 22.5
RT	0 31.5
RU	23 57.7

Scutum Scuti Sct — 4° to	Scut —16° h m
α	18 29.8
β	18 41.9
γ	18 23.5
δ	18 36.8
ϵ	18 38.1
ζ	18 18.2
η	18 51.7
R	18 42.2
S	18 44.9
T	18 50.0
U	18 48.8
V	18 42.5
W	18 18.9
X	18 25.7
Y	18 32.6
Z	18 37.6
RR	18 35.6
RS	18 43.7

Scutum (Continued)

	h	m
RT	18	44.1
RU	18	36.7
RV	18	38.8
RW	18	51.0
RX	18	31.6
RY	18	19.9
RZ	18	21.1
SS	18	38.3
ST	18	45.9
SU	18	47.3
SV	18	48.0
SW	18	48.3
SX	18	49.2
SY	18	45.0
SZ	18	48.2
TT	18	49.2
TU	18	52.1
TV	18	52.4
TW	18	53.3
TX	18	23.8
TY	18	36.9

Serpens
Serpentis

Ser — Serp
+24° to −16°

	h	m
α	15	39.3
β	15	41.6
γ	15	51.8
δ	15	30.0
ε	15	45.8
ζ	17	55.2
η	18	16.1
θ	18	51.2
ι	15	37.1
κ	15	44.2
λ	15	41.6
μ	15	44.4
ν	17	15.2
ξ	17	31.9
ο	17	35.8
π	15	58.0
ρ	15	46.9
σ	16	17.0
τ^1	15	21.2
τ^2	15	27.6
τ^3	15	31.0
τ^4	15	32.0
τ^5	15	31.9
τ^6	15	36.4
τ^7	15	37.4
τ^8	15	40.2
υ	15	42.6
φ	15	52.6
χ	15	37.1
ψ	15	39.0

Serpens (Continued)

	h	m
ω	15	45.2
R	15	46.1
S	15	17.0
T	18	23.9
U	16	2.5
V	18	11.1
W	18	4.1
X	16	14.1
Y	15	8.8
Z	15	11.0
RR	15	26.3
RS	18	11.7
RT	17	34.3
d	18	22.1

Sextans
Sextantis

Sex — Sext
+8° to −11°

	h	m
α	10	2.8
β	10	25.2
γ	9	47.6
δ	10	24.4
ε	10	12.7
R	9	37.8
S	10	29.8
T	9	48.3

Taurus
Tauri

Tau — Taur
+31° to − 2°

	h	m
α	4	30.2
β	5	20.0
γ	4	14.1
δ	4	17.2
ε	4	22.8
ζ	5	31.7
η	3	41.5
θ	4	23.0
ι	4	57.1
κ	4	19.4
λ	3	55.1
μ	4	10.1
ν	3	57.8
ξ	3	21.7
ο	3	19.4
π	4	21.0
ρ	4	28.2
σ^1	4	33.4
σ^2	4	33.6

Taurus (Continued)

	h	m
τ	4	36.2
υ	4	20.3
φ	4	14.2
χ	4	16.5
ψ	4	0.8
ω	4	11.4
R	4	22.8
S	4	23.7
T	4	16.2
U	not var	
V	4	46.2
W	4	22.2
X	3	47.8
Y	5	39.7
Z	5	46.7
RR	5	33.3
RS	not var	
RT	4	58.2
RU	5	46.8
RV	4	41.0
RW	3	57.8
RX	4	32.8
RY	4	15.8
RZ	4	30.8
SS	3	31.4
ST	5	39.4
SU	5	43.2
SV	5	45.8
SW	4	19.3
SX	3	47.0
SY	3	42.8
SZ	4	31.4
TT	4	45.2
TU	5	39.1
TV	4	2.5
TW	4	21.7
TX	4	2.1
TY	4	29.0
TZ	3	57.1
UU	3	41.5
UV	3	50.7
UW	4	51.2
UX	4	24.2
UY	3	48.8
UZ	4	26.7

Telescopium
Telescopii

Tel — Tele
−45° to −57°

	h	m
α	18	19.6
δ^1	18	24.4
δ^2	18	24.6
ε	18	3.8
ζ	18	21.1

Telescopium (Continued)

	h	m
η	19	14.8
ι	19	27.8
κ	18	44.7
λ	18	50.5
ν	19	39.9
ξ	19	59.7
ρ	18	58.4
R	20	7.6
S	19	58.4
T	18	19.0
U	19	0.5
V	19	10.6
W	19	43.0
X	20	11.2
Y	20	12.9
Z	19	32.4
RR	19	56.3
RS	18	11.4
RT	18	36.5
RU	19	0.6
RV	18	35.7
RW	18	36.0
RX	18	59.6
RY	18	19.3
RZ	18	17.8
SS	18	23.8
ST	18	38.9
SU	19	5.0
SV	18	48.6
SW	19	20.3
SX	18	44.5

Triangulum
Trianguli

Tri — Tria
+25° to +36°

	h	m
α	1	47.4
β	2	3.6
γ	2	11.4
δ	2	10.9
ε	1	57.1
R	2	31.0
S	2	21.4
T	1	51.0
U	1	49.7
V	1	26.2
W	2	35.4
X	1	54.9

Triangulum Australe
Trianguli Australis

TrA — TriA
−60° to −70°

	h	m
α	16	38.1
β	15	46.3
γ	15	9.6
δ	16	6.3
ε	15	27.6
ζ	16	17.7
η^1	16	31.1
η^2	16	36.6
θ	16	26.1
ι	16	18.7
κ	15	45.6
R	15	10.8
S	15	52.2
T	not var	
U	15	58.4
V	16	39.8
W	16	41.6
X	15	4.7
Y	16	5.3
Z	16	45.1
RR	16	9.4
RS	16	13.2
RT	16	25.3
RU	16	28.2
RV	15	23.5

Tucana
Tucanae

Tuc — Tucn
−57° to −73°

	h	m
α	22	11.7
β	0	27.0
γ	23	11.6
δ	22	20.2
ε	23	54.7
ζ	0	14.9
η	23	52.3
θ	0	29.1
ι	1	3.3
κ	1	12.4
λ^1	0	48.6
λ^2	0	51.3
ν	22	26.2
ξ	0	19.7
π	0	16.0
ρ	0	38.2
R	23	52.2
S	0	18.4
T	22	34.0
U	0	54.2
V	0	48.2
W	0	54.2

Tucana (Continued)

	h	m
X	22	43.2
Y	23	11.2
Z	0	51.8
RR	0	53.6
RS	0	54.3
RT	0	55.0
RU	0	55.6
RV	0	55.6
RW	0	56.2
RX	0	56.7
RY	0	57.7
RZ	0	57.7
SS	0	58.5
ST	0	59.0
SU	1	0.2
SV	1	0.3
SW	1	0.4
SX	1	0.5
SY	1	1.0
SZ	1	1.2
TT	1	2.5
TU	1	3.8
TV	1	4.2
TW	1	4.3
TX	1	4.4

Ursa Major (Continued)

	h	m
R	10	37.6
S	12	39.6
T	12	31.8
U	10	8.2
V	9	1.2
W	9	36.7
X	8	33.6
Y	12	35.8
Z	11	51.3
RR	13	22.4
RS	12	34.4
RT	9	11.4
RU	11	36.4
RV	13	29.4
RW	11	35.4
RX	9	5.7
RY	12	15.7
RZ	8	1.8
SS	13	58.5
ST	11	22.4
SU	8	3.4
SV	10	40.4
SW	8	29.4
SX	13	22.3
SY	9	49.2
SZ	11	15 3

Vela (Continued)

	h	m
κ	9	19.0
λ	9	4.3
μ	10	42.5
o	8	37.4
ϕ	9	53.4
ψ	9	26.8
R	not var	
S	9	29.4
T	8	34.4
U	9	29.5
V	9	19.2
W	10	11.5
X	9	51.4
Y	9	25.7
Z	9	49.4
RR	10	17.8
RS	9	20.4
RT	10	26.0
RU	10	49.4
RV	9	15.6
RW	9	16.9
RX	9	24.1
RY	10	16.9
RZ	8	33.6
SS	10	48.6
ST	8	41.8
SU	9	46.0
SV	10	40.9
SW	8	40.4
SX	8	41.5
SY	9	8.7
SZ	9	46.2
TT	10	16.2
TU	10	14.4
TV	10	30.5
TW	9	0.1
TX	9	11.0
TY	9	15.2
TZ	9	27.0
UU	9	32.2
UV	9	45.3
UW	9	45.7
UX	10	36.2
UY	10	44.9
UZ	10	45.1
VV	10	45.7
VW	10	51.0
VX	10	54.8
VY	10	56.1
VZ	10	24.2
WW	10	46.1
WX	10	44.8
N	9	28.2
N 1	10	58.3

Virgo Virginis

Vir		Virg
+15°	to	−22°
	h	m
α	13	19.9
β	11	45.5
γ	12	36.6
δ	12	50.6
ϵ	12	57.2
ζ	13	29.6
η	12	14.8
θ	13	4.8
ι	14	10.8
κ	14	7.6
λ	14	13.7
μ	14	37.8
ν	11	40.7
ξ	11	40.1
o	12	0.1
π	11	55.7
ρ	12	36.8
σ	13	12.6
τ	13	56.6
υ	14	14.4
ϕ	14	23.0
χ	12	34.1
ψ	12	49.2
ω	11	33.3
R	12	33.4
S	13	27.8
T	12	9.5
U	12	46.0
V	13	22.6
W	13	20.9
X	11	56.8
Y	12	28.8
Z	14	5.0
RR	13	59.6
RS	14	22.3
RT	12	57.6
RU	12	42.2
RV	13	2.6
RW	12	2.1
RX	11	59.6
RY	13	36.3
RZ	13	16.8
SS	12	20.1
ST	14	22.5
SU	12	0.1
SV	11	55.3
SW	13	8.9
SX	13	31.1
SY	13	53.4
SZ	12	57.4
TT	13	50.3
TU	13	51.5
TV	13	58.8
TW	11	40.3
TX	13	49.8
TY	11	46.7
TZ	11	59.5
UU	12	3.5

Virgo (Continued)

	h	m
UV	12	16.2
UW	13	11.1
UX	13	35.6
UY	12	56.6
N 1	12	25.8

Ursa Major
Ursae Majoris

UMa		UMaj
+30°	to	+75°
α	10	57.6
β	10	55.8
γ	11	48.6
δ	12	10.5
ϵ	12	49.6
ζ	13	19.9
η	13	43.6
θ	9	26.2
ι	8	52.4
κ	8	56.8
λ	10	11.1
μ	10	16.4
ν	11	13.1
ξ	11	12.9
o	8	22.0
π^1	8	30.3
π^2	8	31.5
ρ	8	53.5
σ^1	8	59.6
σ^2	9	1.6
τ	9	2.7
υ	9	43.9
ϕ	9	45.3
χ	11	40.8
ψ	11	4.0
ω	10	48.2

Ursa Minor
Ursae Minoris

UMi		UMin
+66°	to	+89°
α	1	22.6
β	14	51.0
γ	15	20.9
δ	18	4.5
ϵ	16	56.2
ζ	15	47.6
η	16	20.4
θ	15	34.4
R	16	31.3
S	15	33.4
T	13	32.6
U	14	15.2
V	13	36.9
W	16	34.8
X	21	5

Vela
Velorum

Vel		Velr
−37°	to	−57°
γ	8	6.5
δ	8	41.9

Volans
Volantis

Vol		Voln
−64°	to	−75°
α	9	0.9
β	8	24.6
γ	7	9.6
δ	7	16.9
ϵ	8	7.6
ζ	7	43.1
η	8	23.0
θ	8	38.7
ι	6	52.6
κ	8	20.2
R	7	7.4
S	7	31.5
T	6	57.8
U	7	0.0
V	7	42.0

Vulpecula
Vulpeculae

Vul		Vulp
+19°	to	+29°
α	19	24.5
R	20	59.9
S	19	44.3
T	20	47.2
U	19	32.2
V	20	32.3
W	20	5.9
X	19	53.3
Y	19	0.1
Z	19	17.5
RR	20	50.5
RS	19	13.4
RT	19	7.2
RU	20	34.5
RV	19	59.6
RW	19	59.6
RX	20	48.6
RY	19	0.4
RZ	19	42.8
SS	19	50.5
ST	19	56.9
SU	20	7.3
SV	19	47.5
N 1	19	43.5

page 158). This is to be strongly recommended whenever its use saves space in printing. In many cases, however, especially where names of other kinds are printed in the same column, a four-letter abbreviation can be used to advantage; the one recommended here is obtained from the three-letter abbreviation by the addition of a letter and never by any other change. These longer abbreviations more readily suggest the full name than do the three.

It has not been thought necessary to insert stars designated by Flamsteed numbers. These are in the order of right ascension with a few trifling exceptions where precession has altered this order. Consequently, the inspection of any general catalogue (like Ambronn's, Backhouse's, etc.) will lead very quickly to the star in question

It will be noted that the superscribed numbers distinguishing various stars with the same Greek letter (for example, Psi Aurigae) are also in the order of right ascension. There is one curious exception to this; namely, the six stars that are designated as Pi Orionis; these are in the order of north polar distance.

The authors take this opportunity of urging the use of Durchmusterung numbers to designate faint stars. Confusion, unnecessary labor, and occasional error would be avoided if this practice were more general.

Yale University Observatory, October 28, 1924.

AMERICAN ASTRONOMICAL SOCIETY.

REPORTS OF OBSERVATORIES
1923-1924

(Continued from page 35.)

LEANDER McCORMICK OBSERVATORY

UNIVERSITY OF VIRGINIA

The work on trigonometric parallaxes by photography with the 26-inch visual refractor has been continued without interruptions. The details of the parallaxes of four hundred stars have been prepared for the printer and they will appear as a *Memoir of the National Academy of Sciences*. Two hundred and sixty stars appeared in the first parallax volume, so that the number of stars measured is increased to six hundred and sixty. In ninety per cent of all the paral-

laxes completed, the plates have been measured by Mitchell, Olivier, or Alden.

Among the by-products from parallax work the most important so far taken up at the McCormick Observatory has been the measurement of proper motions of Boss stars. In *Astronomical Journal,* No. 843, Alden and van de Kamp describe this work. Proper motions in both right ascension and declination were derived for 321 Boss stars in 287 different regions relative to a total of 1905 comparison stars of mean photovisual magnitude 10.14. The average number of comparison stars measured per region was 6.6, the average number of pairs of plates 2.25 and the average interval between pairs of plates 6.4 years. The results from these measures in right ascension and declination were supplemented by the proper motions in right ascension alone determined in parallax solutions at Allegheny, Sproul, Yerkes, and McCormick Observatories. A comparison of the relative proper motions derived at these observatories with the Boss proper motions of 707 stars provides 942 values of the mean proper motions in right ascension of the comparison stars which were of the same average magnitude as those stars measured in right ascension and declination by Alden and van de Kamp. The combined results give the proper motions of the comparison stars of tenth magnitude and these motions place the right ascension of the solar apex at 270°.7 and give the projected parallactic motion $h/\rho \cos D$ as $0''.0136 \pm ''.0010$.

On the assumption that the declination of the apex is the same for these stars of magnitude 10.1 as for the Boss stars of mean magnitude 5.7, and that the proper motions in the *Preliminary General Catalogue* require a correction of the form $G \cos \delta$, as suggested by Kapteyn, the declination of the solar apex is found to be equal to 25°.7 and $G = +0''.0064$. A comparison of these photographic proper motions with the revised proper motions of the 1925 *American Ephemeris* gives the apex at R. A. 276°.1 and declination +18°.3. This declination agrees well with that derived by Eichelberger from the proper motions of the *Ephemeris* stars.

The dependence on galactic latitude of the mean secular parallax of tenth-magnitude stars was determined from the same data.

Olivier and Vyssotsky have each been measuring double stars found on photographic plates and also on plates specially exposed. Each has also been measuring doubles visually with the micrometer attached to the 26-inch. These observers find that doubles with a separation less than two seconds of arc can be more reliably measured with the micrometer, while for those stars separated more than three seconds the measures from photographs are preferable.

Visual observations on two hundred variable stars of long period are being continued, mainly by Mitchell and Alden. The results of observations made during the past twenty years are being prepared for publication. Not only will the observed magnitudes of the vari-

ables be given but the magnitudes of the comparison stars derived at Harvard will be revised and the sequences extended to stars of the fifteenth magnitude or fainter.

Photographic plates have been taken by Alden on the Kapteyn Selected Areas at +75° with exposures on the same plates of the North Polar Sequence. The plates will be sent to the Kapteyn Astronomical Laboratory, where they will be measured by van Rhijn for the purpose of determining photovisual magnitudes.

Mr. Charles P. Olivier, associate professor, was absent on leave from October 1, 1923, to July 1, 1924. During his absence he carried on special work on meteors. The members of the American Meteor Society continue the work of sending observations to the McCormick Observatory for discussion by Olivier.

The Observatory records with regret the resignation on June 1 of Miss Eudora Magill as computer.

S. A. Mitchell, *Director.*

DETROIT OBSERVATORY
University of Michigan
Ann Arbor, Michigan

Instruction. A considerable portion of the time of each member of the staff is devoted to the work of instruction. Several large sections of descriptive astronomy are given each semester. There are courses also in spherical and practical astronomy, in theoretical astronomy, and in astrophysics for undergraduate and graduate students. In the interval considered in this report, four students engaged in thesis work. Of these two, Dean Agnes E. Wells, of the University of Indiana, and Miss Hazel Marie Losh, received the degree Ph. D. in June, 1924.

Research. Observations with the single-prism spectrograph attached to the 37½-inch reflector were continued through the year, and 767 spectrograms were obtained. The principal program related to stars of Class B, with emission line spectra, north of —20° declination. A second program carried to completion the observation of the Pleiades which are brighter than the seventh magnitude. A third program included five of the brighter eclipsing variables, namely, Algol, λ Tauri, δ Librae, RZ and 21 Cassiopeiae. A few spectrograms of ε Aurigae were made in connection with studies of eclipsing stars. A program of observation of Cepheid variables was continued in the case of η Aquilae and was extended to include δ Cephei. Individual stars observed and not included above were ξ Persei, BD +56°2617, and R Scuti.

Velocities were derived from the spectrograms of the Pleiades and the material prepared for publication. Studies of ζ Tauri brought out a variation of long period in the center of mass velocity of the star or system of stars, and marked differences were observed in the curves of velocity variation derived from different groups of lines.

Studies of velocity curves with especial attention to irregularities due to rotational velocities during partial eclipse have been carried on in the cases of β Lyrae, Algol, λ Tauri, and δ Librae. Studies of W Sagittarii and η Aquilae have brought out for lines of greater chromospheric height departures from velocity curves due to low level elements, similar to though not identical with those discovered by Aldrich in S Sagittae.

Spectral studies of ϕ Persei, BD $+56°2617$, R Scuti, β Librae, ρ Leonis, 25 Orionis, χ Ophiuchi, υ Cygni, Nova Geminorum 1912, Nova Aquilae 1918, and Nova Cygni 1920 were also carried on during the year.

Those engaged in the spectroscopic observations and investigations were the following: R. H. Curtiss, W. C. Rufus, R. A. Rossiter, O. L. Dustheimer, Agnes E. Wells, Hazel Marie Losh, D. B. McLaughlin, H. F. Schiefer, P. A. Smith, and D. W. Lee.

Publications. Two articles have been published in the *Astrophysical Journal,* and abstracts of several papers read before the American Astronomical Society in *Popular Astronomy.*

Equipment. A new two-prism spectrograph has been constructed in the Observatory shop, with optical parts by J. B. McDowell. A Hartmann spectro-comparator has been purchased. The 27-inch visual objective for the Lamont telescope has been completed by Mr. Hageman, who for many years has been associated with the John A. Brashear Company of Pittsburgh. This telescope is intended for double star work in the southern hemisphere. Mr. Hussey visited South Africa, and during December, 1923, and January, 1924, made tests of seeing at Bloemfontein, Orange Free State, with a ten-inch refractor, which he took there for that purpose. It is probable that the Lamont expedition will be sent to Bloemfontein for the contemplated double star work in the southern hemisphere.

W. J. Hussey, *Director.*

MOUNT WILSON OBSERVATORY

CARNEGIE INSTITUTION OF WASHINGTON

PASADENA, CALIFORNIA

During the year the Observatory has had a part in two undertakings of general interest in which its experience and facilities have offered an especially favorable opportunity for service. The first of these was the design and construction of a vertical telescope and spectrograph for the new building of the National Academy of Sciences in Washington, which were completed in season for the dedication of the building in April. The vertical telescope gives a solar image 6 inches in diameter. The spectrograph is equipped with a motor for moving the spectrum through the field of view, and a device for observing a

comparison spectrum side by side with that of the sun. Used in conjunction with the telescope, it affords excellent opportunity for examination of the solar surface and for observations of the solar spectrum. A torsion seismometer of the design by Mr. Anderson and Mr. Wood was also constructed and added to the permanent exhibit at the Academy building.

The second project is the establishment of a private observatory for solar research by Dr. Hale. Prevented by illness from taking an active part in the observational work on Mount Wilson, Dr. Hale commenced on his return from Europe an investigation of solar observing conditions in the vicinity of Pasadena. This led to the conclusion that although the best morning conditions on Mount Wilson probably are not equalled in the valley, during a portion of the day the seeing in Pasadena is superior. On Mount Wilson the heated mountain slopes appear to produce injurious convection currents in the middle of the day, while in Pasadena the level character of the country reduces greatly the effect of radiation from the ground. It seems probable, therefore, that Dr. Hale's observatory in Pasadena will supplement in many important ways the work of the instruments on Mount Wilson, and at the same time will afford occasional opportunities for observing the sun at times when the mountain top is enveloped in fog. While the principal expense of the construction of the new "Solar Laboratory," as it will be known in the future, will be borne by Dr. Hale personally, the Carnegie Institution of Washington has assisted through the aid of a specal grant for equipment, and the Mount Wilson Observatory is coöperating through its departments of design and construction and its optical and instrument shops in the erection of the building and the manufacture of the apparatus. On its completion the building and the lot on which it stands will be transferred by Dr. Hale to the Carnegie Institution, and the Solar Laboratory will be conducted as a permanent branch of the Mount Wilson Observatory.

Two results of first importance have characterized the solar investigations of the year. The first of these is the confirmation by Hale of the reversal of the polarities of sun-spots at minimum, a result first suspected in 1912 and described by Hale, Ellerman, Nicholson and Joy at that time, but requiring a second period of minimum activity for final decision. An appreciable increase in solar activity in May and June, 1924, as shown by the tabulations of spot numbers by Nicholson, makes it certain that the sun-spot minimum has passed; and 16 groups belonging to the new cycle, as evidenced by their high latitudes, showed, without exception, the reversal, while 18 groups of the old cycle had polarities consistent with the regular behavior of that cycle. Here again there were no exceptions, although for 6 additional groups the polarities could not be determined. This discovery cannot fail to be of vital significance in its bearing on sun-spot theory and the cycle of solar activity.

Second, the confirmation by St. John of the gravitational shift of the lines in the solar spectrum seems to afford final evidence for the validity of the theory of general relativity. St. John's results, based upon over 330 iron lines, show in a simple and convincing way the effect of the combination of the relativity displacement with that due to convection currents in the solar atmosphere and explain many of the difficulties encountered by observers in this field. The differences in wave-length, sun *minus* vacuum arc, show systematic displacements of the solar lines toward the red which, in the mean, agree with the shift predicted by Einstein. Grouped according to line intensity, the differences increase progressively with the intensity. Line intensity, on the average, however, is an indication of level in the solar atmosphere at which the lines originate. Downward convection currents at high levels, and upward currents at low levels with maximum velocities of the order of 0.2 or 0.3 km/sec. would remove the progression in the differences. That such currents exist, in the case of certain elements at least, is well known. The correlation of the progression with level is confirmed by a direct comparison of the behavior of enhanced and normal solar lines.

Among other results obtained in the department of solar research, reference should be made to the work of St. John and Babcock on pressure in the sun's atmosphere, which confirms by direct methods the conclusion that the pressures in the reversing layer are extremely low. Additional data on the solar wave-length of iron lines and new laboratory data on pressure displacements permit the effective comparison of lines having large and small values of the pressure coefficients for the direct determination of the pressure. The mean result of 0.13 ± 0.06 atmosphere for the lower few hundred kilometers of the reversing layer agrees well with various theoretical indications. The low value of the pressure removes restrictions formerly placed on the selection of lines for the study of various problems and simplifies greatly the interpretation of solar displacements.

During the year St. John and Babcock, using the 150-foot tower telescope and the interference apparatus and auxiliary spectrograph of the physical laboratory, have continued their determinations of standard wave-lengths of solar lines on the international system.

Pettit has begun a study of the ultra-violet solar radiation for the purpose of detecting possible fluctuations. Silvered quartz plates are used for the transmission of the radiation, which is automatically recorded at intervals of 2 minutes throughout the day. No large fluctuations have yet been observed.

An important auxiliary to the spectrograph, especially for the study of eruptive solar phenomena, is the spectrohelioscope, a device perfected by Hale during the year, which permits the visual observation of the forms of the prominences and the bright and dark hydrogen flocculi on the disk. The use of an oscillating bar carrying a group of

narrow "first" and "second" slits, the latter being set on the *Hα* line of hydrogen, gives monochromatic images of high purity.

In the field of stellar astronomy the investigations of Seares on the distribution functions of stellar velocities and the form of the luminosity function have led to results of great interest. Expressions have been derived for these functions and for the coefficients involved, which show an excellent degree of accordance with observation and provide a valuable basis for theoretical studies of velocities, mean parallax, and stellar density. Hitherto it has seemed probable that the frequencies of intrinsically faint stars in a given volume of space decrease with increasing absolute magnitude; but it is now found that the relative numbers, in the vicinity of the sun at least, continue to increase to the lowest limit of brightness for which we have available data. The resulting density to the fifteenth absolute magnitude is about twice the previously accepted figure for all magnitudes together. The total number of very faint objects must be enormous.

Strömberg has continued his study of the asymmetry of stellar motions and finds a sequence among the stars in accordance with which the group-motion changes in a regular way with the dispersion in velocity. The relationship between group-motion and dispersion along an axis parallel to the group-motion can be expressed by the equation of a parabola. This permits the representation of stellar velocities as the product of two distribution functions symmetrical about two centers in the velocity-space, and leads to most interesting hypotheses as to the conditions governing the phenomena of stellar motion.

Among other results of interest in this field are the following: Hubble has discovered several Cepheid variable stars in the great spiral nebula of Andromeda, from a study of which it may be possible to determine the distance of the nebula.

St. John and Adams have investigated the relative displacements of lines in the spectra of certain stars and found definite evidence for the existence of convection currents in their atmospheres. The differences between high and low-level lines correspond to relative velocities which increase with the surface temperature of the stars, and, in the case of Sirius, amount to 1.2 km/sec.

Nicholson and Pettit have continued their measures of stellar and planetary radiation with the vacuum thermo-couple. A rock-salt window on the cell and the use of a thin glass screen show that the long-wave radiation increases steadily with spectral type until it amounts to 75 per cent for stars of type M7e. A remarkable fact is that, although the light of a long-period variable may vary many thousand fold, the total radiation changes but two or three times the amount.

Van Maanen has completed the determination of 25 additional trigonometric parallaxes, bringing the total to 191 fields. A dozen parallaxes measured at the 42-foot focus of the Hooker telescope

indicate a precision only slightly less than that obtained at the 80-foot focus of the 60-inch reflector.

Merrill and Strömberg find that the absolute magnitude of long-period variables of types Me and Se is about zero, and that the ellipsoids representing their velocity distribution fall into the general sequence discovered by Strömberg.

Joy has studied the spectrum of o Ceti in detail. An asymmetry in the lines led him to suspect that the star might be double, and Dr. Aitken of the Lick Observatory subsequently found the companion in the position angle indicated by the spectroscopic observations.

Determinations of spectroscopic parallaxes have been continued regularly throughout the year by Adams, Joy and Humason. Charts of spectra made with the registering microphotometer have aided the selection of additional lines for use in deriving absolute magnitudes. A special study of about 200 M-type stars is nearly completed.

Sanford has investigated the radial velocities of R-type stars and of numerous spectroscopic binaries, and has determined the radial velocities of many additional stars, while Humason has observed the spectra of faint stars in globular clusters and in Kapteyn's Selected Areas.

In the physical laboratory the work of the year has included the temperature classification of the lines in the ultra-violet spectra of vanadium and chromium by King, and the measurement of the wave-lengths of many new lines; the continuation by Anderson of his studies with the vacuum spark of the spectra of oxygen and nitrogen, and by Carroll of several other elements; a special investigation by Babcock of the Zeeman effect for vanadium which has resulted in an improvement in the values of the observed separations of close components and has eliminated practically all the inconsistencies with the results required by the quantum theory; an interesting study by Sinclair Smith of the spectrum of electrically exploded wires, in which, by the aid of a special device for moving the spectrum rapidly, a photograph could be made showing the variation of the spectrum during the period of the explosion; further investigations by King of the successive stages in the development of the ionized spectrum of some of the elements with numerous lines, and the use of a direct-current arc with currents of the order of 1000 amperes to produce a spectrum intermediate between that of the ordinary arc and that of the spark; and the continuation by Babcock of interferometer measurements of standards of wave-lengths, more especially such as belong to the system of secondary standards.

A very complete analysis of the arc and spark spectrum of titanium has been carried out by Dr. Russell, research associate, during the year. Almost without exception, every important line has been classified according to the energy level involved in the atom and its relationship in the system of spectral regularities. From the results of his own work

and that of other investigators, Dr. Russell has compiled a list of all the more important lines of the elements which have been studied for spectral regularities which are likely to prove of astrophysical importance. Within the short period of its existence this list has already found many valuable uses.

Dr. Michelson, research associate, has continued his investigations which have for their purpose a redetermination of the velocity of light. The use of a Sperry arc light has provided a powerful source of illumination, sufficient even under average conditions of transparency. Further tests of the rotating mirror and of means for measuring its speed have removed the outstanding instrumental difficulties, and there now remains little to be done but the observational work itself.

A most successful application of the radiometer to the measurement of the spectral radiation of the brighter stars was made by Dr. Charles G. Abbot, director of the Astrophysical Observatory of the Smithsonian Institution, in October of last year. Using the 100-inch telescope and a special optical system devised for the purpose, he secured measurements of the energy radiation from nine stars in regions of the spectrum extending from the ultra-violet to $2.2\,\mu$ in the infra-red. The comparison of the results with those of a black body radiator and the conclusions regarding surface luminosity and dimensions of the stars of the different spectral types are of the greatest interest.

The regular staff of the Observatory has remained unchanged. Dr. Henri L. Vanderlinden of the Royal Observatory of Belgium has been a volunteer assistant since September 1, 1923. Mr. John A. Carroll, Isaac Newton student of Cambridge University and Research Fellow at the California Institute of Technology, has carried on investigations in the physical laboratory of the Observatory. Dr. S. A. Mitchell, director of the Leander McCormick Observatory, spent the summer months of 1924 at the Observatory, and Dr. J. H. Oort of the Leiden Observatory, Professor I. Yamamoto of the University of Kyoto, and Professor Margaret Harwood of the Maria Mitchell Observatory served as volunteer assistants for varying periods during the year.

WALTER S. ADAMS, *Director.*

UNITED STATES NAVAL OBSERVATORY

WASHINGTON, D. C.

Changes in the staff in the year ending June 30, 1924: CAPTAIN EDWIN T. POLLOCK, U. S. N., Superintendent, vice REAR ADMIRAL W. D. MACDOUGALL, U. S. N.; *Department of Material (Naval):* LIEUT. JOHN MEYERS, U. S. N., vice LIEUT. H. A. PINKERTON, U. S. N.; *Magnetic Compasses, Air Navigation and Aerological Instruments:* COMDR. W. L. BECK, U. S. N., vice COMDR. W. F. NEWTON, U. S. N.; *Nautical Instruments and Time Service:* LIEUT.-COMDR. J. F. CROWELL, U. S. N., vice LIEUT.-COMDR. J. G. STEVENS; W. C. MEYERS vice F. E. SWINDELLS; *Supply Division:* F. J. HALLOCK vice H. G. HODGKINS.

The Naval Observatory has continued to supply the navy, the merchant marine and the country with the essential astronomical data and

time service required by navigators, astronomers, and scientists in general.

The use of time signals for scientific purposes has continued to increase during the year. They are used by many of the principal observatories, and by the U. S. Coast and Geodetic Survey in its field work.

The main features of the astronomical and receiving station for differences of longitude operations around the world by radio have been prepared at the Naval Station in San Diego, California. It is expected that this work will be done in conjunction with the French and other government astronomical and communication agencies.

The Appendix to Volume X, *Publications of the U. S. Naval Observatory,* Second Series, containing the results of the total solar eclipse expeditions of 1905 and 1918 is in press. It will also contain a brief account of the attempts to secure photographs of the solar corona from naval airplanes during the eclipse of 10 September 1923.

The Naval Observatory issued a circular calling attention to the transit of Mercury of May 7, 1923, and a considerable number of observations of contact times were sent to the Observatory, and have been prepared for publication.

The time of first contact, of the total solar eclipse of 10 September 1923, which was visible at Washington as a partial eclipse, was observed visually and photographically.

Nautical Almanac Office

The *American Ephemeris and Nautical Almanac* for 1926 was received from the printer on March 17, 1924.

The investigation of the orbits of Saturn's satellites has been continued.

The determination of the orbit of Neptune's satellite based on 33 oppositions from 1889 to 1923 will soon be ready for publication.

The new star catalogue, "Positions and Proper Motions of 1504 Standard Stars," is in press.

Department of Astronomical Observations

6-inch Transit Circle and Prin Transit. With the 6-inch transit circle, 1129 transits were observed and 462 sets of instrumental constants were measured on 152 nights for the determination of time. With the Prin transit 863 transits were observed, on 122 nights. The additional observations made with the latter instrument were for the purpose of investigating the causes of the errors of time signals. The results from these two instruments, mounted in very different kinds of houses, continue to show practically no difference in the determination of clock corrections. The monthly means of the differences vary from $+0^s.030$ to $-0^s.026$, and the mean for the year is $+0^s.003$.

The printer's copy of the 50,000 observations of the sun, Mercury, Venus and standard stars made during the period 1909-1918 has been

completed, and the material is nearly ready for publication.

Clock Vault and Clocks. The temperature of the clock vault was practically constant during the year and the three standard Riefler clocks ran very satisfactorily.

9-inch Transit Circle. The total number of observations in right ascension and declination of standard and intermediary stars, sun, moon, and planets was 5332 with 2823 measures of instrumental constants.

Since the beginning of this series 67,634 observations have been secured. From 8454 observations on 698 nights, definitive positions of the 186 clock stars have been obtained. The comparison of these with the positions in the new catalog of Professor Eichelberger gives the following:

$$\Delta\alpha = +0^s.002 \sin\alpha - 0^s.003 \cos\alpha + 0^s.000 \sin 2\alpha - 0^s.002 \cos 2\alpha.$$

About 1000 observations are needed to complete this series. The completion of the reductions, however, will take a number of years.

Equatorials. With the 26-inch equatorial, observations have been made as follows: Comparison stars, 7; occultations, 51; Comet 1922 *c* (Baade), 3; Asteroids: Ceres (1), 6, Eros (433), 11, 1923 PE, 8; Eclipses of Jupiter's satellites I and II, 4.

Determinations of the following were also made: Instrumental constants, parallels, and coincidences, total 114.

With the 12-inch equatorial, the following observations were made: 36 occultations, 1 eclipse of Jupiter's satellite I, and the partial eclipse of the sun of September 10, 1923.

There were 2313 visitors on 64 nights.

The discussion is well under way of the observations of the four pairs of Saturn's satellites: Titan-Rhea, Rhea-Dione, Rhea-Tethys, and Dione-Tethys, observed during the period 1909-1916.

Photographic Equatorial. Photographs were made of 33 asteroid fields on 27 nights.

The asteroid found by Mr. Peters on the plate with Edburga (413) on 23 May 1923 proved to be new, and was named "Potomac."

Photoheliograph. Photographs of the sun were made on 236 days. Solar spots were observed on 121 of these photographs.

The Naval Observatory and the Western Union Telegraph Company have continued their coöperative exchange of data for the investigation of the relation of solar disturbances to auroras, and terrestrial magnetic storms which interfere with telegraphic communication.

Six photographs were made of the partial phase of the total solar eclipse of 10 September 1923.

Photographic Zenith Tube. The number of stars observed for variation of latitude was 1960 on 132 nights. The results for 1923 are nearly ready for publication. They give $20''.458 \pm 0''.012$ for the aberration constant.

Prime Vertical Transit. The number of observations for declination made with this instrument during the year was 487.

The results of the 8000 observations made from 1893 to 1912 have been sent to the printer.

From the observations of α Lyrae during that period, the following results have been obtained:

Proper motion, annual	$+ 0''.3001 \pm 0''.0017$
Parallax	$+ 0.1226 \pm 0.0293$
Aberration constant	20.580 ± 0.0113
Nutation	9.2498
Reciprocal of mass of moon	80.54

From the observations of stars by the polygon method:

Aberration constant	(1) $20''.542 \pm 0''.010$
	(2) 20.550 ± 0.006

Charts have been formed showing graphically the daylight effect on the observed declinations of α Lyrae.

Library. The library contains 38,305 volumes and pamphlets, 668 having been added during the year.

EDWIN T. POLLOCK, Captain, U. S. N.
Superintendent.

PRINCETON UNIVERSITY OBSERVATORY

PRINCETON, NEW JERSEY

Personnel is same as last year except that Mr. Menzel has received his doctorate and accepted a position in the University of Iowa.

Buildings and Equipment. The dome of the 9½-inch telescope, which weakened and sagged at the end of last year, has been repaired.

Theoretical Researches. Mr. Russell and Miss Moore have continued the statistical study of double stars, which is nearly ready for publication. Comparisons with trigonometric and spectroscopic parallaxes show, in general, a good agreement, and confirm the relation already found between absolute magnitude and mass, which is in close accord with Eddington's new theory.

Mr. Russell has been engaged mainly in spectroscopic work. An analysis of the spectra of Ca, Sr and Ba (undertaken jointly with Professor F. A. Saunders) is in press. One of the arc spectrum of titanium is practically completed (1214 lines having been classified), that of the spark spectrum of Ti well forward (324 lines, so far), and of the iron spark in progress (166 lines).

A list has been prepared showing the series classification and energy relations for all important lines of the elements for which data are available. At the present writing, arc spectra of 40 elements and spark spectra of 16 elements are included. (This list and the detailed

discussion of titanium and iron, will be published in the *Contributions from the Mount Wilson Observatory*.) In the preparation of this list, as in the researches mentioned previously, very valuable aid has been given by members of the Mount Wilson staff and of the spectroscopic division of the U. S. Bureau of Standards. A preliminary report on the sun-spot spectrum, indicating that these data are likely to be of importance in this, as well as in many other problems, was made to the Society at the Dartmouth meeting.

Mr. Stewart has carried on a theoretical study of the general problem of gas opacity. This is still in progress, and has not been reported on. Particular applications have been made to the determination of pressures in the solar atmosphere, to the quantitative study of the selective opacity indicated by Fraunhofer lines, and to the estimation of the temperatures of stellar reversing layers.

Miss Moore has measured and reduced 34 of the Harvard lunar plates.

Observational Researches. Mr. Dugan made 17,168 photometric measures of eclipsing variables. The observations of RY Aquarii were completed; those of WW Aurigae, TW Andromedae, SX Cassiopeiae, Y Cygni, TY Pegasi, U Coronae, RT Sculptoris and X Trianguli were continued, the last two nearing completion; series on RX Hydrae and W Ursae Minoris were begun; and series on RT Andromedae and RX Cassiopeiae are contemplated. RT Persei, Z Draconis and RZ Cassiopeiae were observed for investigation of periods.

Contribution No. 6, containing discussion of observations of Y Camelopardalis, SZ Herculis, RS Vulpeculae, R Canis Majoris and RY Aquarii, was put through the press and distributed.

HENRY NORRIS RUSSELL, *Director.*

SMITHSONIAN ASTROPHYSICAL OBSERVATORY
WASHINGTON, D. C.

There have been several features of particular interest during the year, including the installation of daily telegraphic reports from the Arizona and Chile solar-radiation stations, certain experimental forecasts based on these reports, and the measurement of the energy distribution in the spectra of ten of the brighter stars.

Arrangements have been made to test the value of the solar measurements for forecasting according to the methods of Mr. H. H. Clayton. For this purpose Mr. Clayton receives before noon daily from the Smithsonian Institution the weighted mean of the solar-constant values observed in Arizona and Chile on the preceding day. He makes his forecasts for 3, 4, 5, and 27 days in advance, and mails them to the Institution on the same afternoon. Thus we receive the forecasts sufficiently long before their maturity to make a very real and searching test of their validity.

These forecasts for definite days relate to the mean temperature of New York City, and are later on compared with the observed temperatures and analyzed by several purely mathematical methods quite independently of any bias of the computer. That they do show some prevision of the event, even to five days after the solar observations, is certain. Hitherto, however, the 27-day detailed forecasts have shown no correlation with the New York temperatures. Mr. Clayton has furnished also general statements as to the expected departure from mean normal temperatures for coming months. These have been made from 15 to 30 days before the beginning of each month from December, 1923, to the present time. He also furnishes similar predictions about the approaching weeks furnished three days before the beginning of the week in question. With few exceptions, these broader prognostications have been fairly verified.

An outfit for the Argentine Government's new solar-radiation station at La Quiaca was prepared at the Smithsonian Institution. Shipment was made in January, 1924, and the station at La Quiaca made ready for solar observing in June, 1924. Thus the Argentine Government is the first agency outside the Smithsonian Institution to undertake regular determinations of the variation of the sun. Their official weather service still receives daily telegraphic reports from our station at Montezuma, Chile, and it will supplement these by its own solar radiation measurements at La Quiaca.

Field Work at Mount Wilson. The director and Mrs. Abbot occupied this station from July to October, 1923. Three objects were in view—First, to set up apparatus and begin observations on the variations of atmospheric ozone after the ingenious spectroscopic method of Fabry and Buisson. M. Fabry was so kind as to supervise the ordering in Paris of all the special quartz and fluorite optical parts needed. Owing to other work the instrument was not quite ready to begin the ozone observations in 1923.

The chief piece of work attempted was with the 100-inch telescope on the energy spectrum of the brighter stars. Messrs. Abbot and Aldrich had, indeed, done this with moderate success in 1922, employing the vacuum bolometer and galvanometer. But great trouble had been found in the use of those instruments at extreme sensibility. Fortunately, the late Dr. E. F. Nichols had offered to have prepared a radiometer of improved design for the work. This instrument, constructed by Dr. J. D. Tear, proved equally as sensitive as the bolometer used in 1922, and practically as easy to use as a meter stick.

With it and with a new optical arrangement designed by the director and largely constructed by him, very interesting results were obtained. The spectra of 10 stars, including the sun, as cast by a 60° flint-glass prism, were measured successfully. As the sun's energy spectrum is well known, it was possible to eliminate by comparison with it all of the chief instrumental and atmospheric losses. Thus the results appear

as stellar energy curves outside our atmosphere, expressed on the normal or wave-length scale. As the deflections observed were fairly large, no less than 50 millimeters at maximum in the spectrum of Betelgeuse, for example, the curves are of very fair accuracy over most of their extent. It was possible to improve them in the shorter wave-length region where they were inaccurate by employing visual and photographic results of German observers. Thus the whole of the intense part of the spectrum of the yellow and red stars and a large part of that of the white and blue ones were well delineated. From these results good estimates could be made of the star temperatures on the "black-body" basis. Furthermore, estimates of the diameters necessary in "black-bodies" to produce at those temperatures the observed amounts of energy were made. It is gratifying to find these results on stellar diameters as accordant as could be expected with those of Pease made by means of Michelson's method of the interferometer. A summary follows:

Stellar Temperatures, Radiation, and Diameters

Star	Absolute temperature C. °	N [1] Unit = 10^{-11}	Parallax	Diameter ⊙=1 [2] Radiometer	Diameter ⊙=1 [2] Interferometer	Diameter ⊙=1 [2] Russell
Sun	6000	....	.....	...	...	..
β Orionis	16,000	3.20	0".007	20	...	28
α Lyrae	14,000	6.10	.130	2	...	3
α Canis Majoris	11000	6.60	.370	1.2	2	....
α Canis Minoris	8000	1.24	.315	1.1	...	1.6
α Aurigae	5800	2.20	.071	13	...	9
α Tauri	3000	2.54	.053	70	39	....
β Pegasi	2850	1.11	.026	94	82	....
α Orionis	2600	7.90	.017	510	280	....
α Herculis	2500	3.60	.007 .013	900 480	...	230

[1] N = ratio of stellar to solar radiation outside earth's atmosphere.
[2] To express in kilometers, multiply by 1.42×10^9. To express in miles, multiply by 0.865×10^9.

C. G. Abbot, *Director.*

SPROUL OBSERVATORY

Swarthmore College

Swarthmore, Pennsylvania

The work of the Observatory has been continued along the lines described in the last report.

1. Determination of stellar parallaxes (trigonometrically). The 24-inch visual refractor is used practically every clear steady night during parallax hours. Plates were exposed on 89 nights during the year ending June 30, 1924. About as many plates were measured and reduced as were made.

2. We have extended the program of measuring double stars photographically.

3. An expedition from the Observatory observed the total solar eclipse of September 10, 1923, at Yerbanis, Mexico. The details of the installation and a discussion of the results obtained will appear in the *Astrophysical Journal*.

4. Professor Comrie continued his predictions of occultation of stars by the planets.

Inasmuch as all the older members of the staff devote considerable time to teaching, the work on any problem is largely coöperative. Any one is likely to contribute to any one of the problems. Perhaps Mr. Pitman gave during the past year more time to parallax than any other; Miss Onderdonk to measuring and reduction of plates; Messrs. Miller and Marriott to the eclipse work.

JOHN A. MILLER, *Director*.

OBSERVATORIO ASTRONOMICO NACIONAL

TACUBAYA, MEXICO

Observations were made of the total eclipse of September 10, 1923, at Yerbanis, half way between Durango and Torreon, where Dr. J. A. Miller, from the Sproul Observatory, was installed. Another small party was sent also to Laguna Seca, San Luis Potosi. Both expeditions obtained good pictures of the corona. (See *Popular Astronomy*, November, 1923.)

The printing of another volume of the Astrographic Catalogue has been prosecuted.

Magnetic observations were made in the Teoloyucan Magnetic Observatory and at eighteen points of the Republic.

The Carnegie Institution sent two members of its staff to observe the magnetic components in some points of Mexico, and also to compare their instruments with those of Teoloyucan.

The one-prism spectrograph by the J. A. Brashear Company, Suc. was adapted to the 38-cm refractor, and the first trials proved the best quality of the construction. Constants of this instrument were determined.

Mars observations with the 38-cm refractor began on May 30.

Standard time for states of Veracruz and Oaxaca was modified January 1, 1924, using six hours from Greenwich instead of seven hours.

Originals of the *Anuarios* for 1925 and 1926 were computed.

In January, 1924, the staff was reduced by eleven persons, there remaining only the director, three assistants, the chief of the magnetic department, and two aids.

JOAQUIN GALLO, *Director*.

VAN VLECK OBSERVATORY

WESLEYAN UNIVERSITY

MIDDLETOWN, CONNECTICUT

Mr. N. W. Storer, M. A., has been added to the staff as assistant.

As in the past most of the time of the staff has been devoted to teaching, but in so far as time permitted, the stellar parallax program has been continued, attention being given chiefly to faint stars with large proper motion and to a few first magnitude stars. During the year 250 plates were taken with the 20-inch refractor.

Among minor observations may be noted observations of the transit of Mercury, occultations of the Hyades, occultation of Venus, positions of comets and asteroids. Investigations of the effects upon parallax determinations of atmospheric dispersion and of guiding error have been carried out.

FREDERICK SLOCUM, *Director.*

WASHBURN OBSERVATORY

UNIVERSITY OF WISCONSIN

MADISON, WISCONSIN

There have been no changes in the staff during the year.

An expedition was organized for observing the eclipse of September 10, 1923, at Catalina Island, California, the personnel comprising Mr. Stebbins and Mr. O. E. Romare, mechanician, from the University of Wisconsin, Dr. Jakob Kunz from the University of Illinois, and Mr. W. R. Jewell, voluntary assistant from Danville, Illinois. The preparations went for naught because of the unfavorable weather on eclipse day.

The 15-inch refractor was used on 102 nights for photo-electric photometry, the observing being divided between Mr. Stebbins and Mr. Huffer. The program included the determination of light-curves of eclipsing variables of small range, the tests of numerous spectroscopic binaries for light-variation, and experiments on the precise measure of color-indices of stars by means of absorbing glasses. The most striking new variable discovered is 21 Cassiopeiae, with eclipse variation of 0.4 magnitude, by far the greatest range thus far found in our observations.

Mr. Huffer checked the precessions, and computed the secular variations for a list of some three hundred proper-motion stars observed with the meridian circle by the late Mr. Flint. It is expected that this work will be published during 1925.

JOEL STEBBINS, *Director.*

YALE UNIVERSITY OBSERVATORY

NEW HAVEN, CONNECTICUT

Staff. Miss Margaretta Palmer, research assistant, who had been connected with the Observatory for many years, met with an automobile accident on January 16 from the effects of which she died two weeks later. During her connection with the Observatory she had had charge of the Yale Index of Star Positions and had computed the definitive orbits of three comets. Since the reorganization of the Observatory most of her time was taken up in assisting in the compilation of the General Catalogue of Stellar Parallaxes. Miss Mildred Booth, computer, resigned at the end of last year to be married. Mr. J. H. Oort, who was temporary assistant last year, served in the same capacity during about half of this year. Mr. C. H. Davis was engaged as computer for one year to assist Professor Brown chiefly in his work on the Trojan planets.

The Loomis Coelostat Telescope. During the year Mr. Stearns has continued his work on variable stars with this telescope. He secured 540 exposures on 119 plates taken on 49 different nights. Of these plates he has measured 69.

The Reed Telescope, an eight-inch visual refractor, has as heretofore been used for visitors.

The Zenith Camera, a ten-inch photographic instrument intended primarily for observing variations in latitude. The lens for this instrument was sent on April 30, 1923, to the maker for correction. It was returned to the Observatory early in September, from which date experiments were resumed and were continued throughout the year. On 113 nights Mr. Oort and Mr. Stearns secured 144 latitude plates and 35 for miscellaneous purposes; they have measured 107 of these plates.

Catalogue Camera, a six-inch photographic lens of wide field. This lens has also had to be returned to the maker for correction and is now in his hands. The very large measuring machine necessary in connection with this work was ordered in October, 1921, and was finally delivered to the Observatory in February, 1924. A measuring machine of this size is something of an experiment, and we were accordingly gratified to find upon investigation that its errors are satisfactorily small.

Miss Barney, assisted by several computers, has now finished the routine calculations relating to the photographic duplication of the zone from 50° to 58° north declination which will give the accurate places of more than 8000 stars. All of these stars were observed about forty years ago and we thus have on hand the material for 8000 proper motions. This work will appear during the coming year as a *Transaction* of the Observatory.

Miscellaneous. During the first half of the year Miss Palmer assisted in the compilation of the Catalogue of Stellar Parallaxes. After her death in January her work on this Catalogue was assumed by Miss Pond. The catalogue was printed by an inexpensive photographic process in April, 1924, and advance copies were distributed at once to those astronomers who are most likely to make immediate use of it. The catalogue reduces all series thus far published to the same system and indicates the reliability of each result. In addition to the parallax there are given all other data concerning the 1870 stars included. A card catalogue, giving these data as they are sent in by observatories engaged in this work, is being kept up to date and it is our intention to issue a second and succeeding editions of the Parallax Catalogue as occasion warrants.

Mr. Brown has completed his paper on the general motions of the asteroids of the Trojan group, together with a numerical application to *Achilles* and is now preparing it for publication in the *Transactions* of the Observatory. His investigation of the orbit of the eighth satellite of Jupiter is well advanced. A preliminary account of his explanation of the gaps in the distribution of the asteroids has appeared in the June number of the *Proceedings of the National Academy of Sciences;* the detailed investigation is being prepared for the *Transactions* of the Observatory. A paper on the internal motions in the spiral nebulae has been sent to the *Astrophysical Journal.* An analysis of the oscillations of the lava column of the volcano Kilauea in Hawaii has been completed and will be published in the near future. The greater part of the numerical work needed in these investigations has been carried out in a very satisfactory manner by Mr. Davis.

Mr. Oort has investigated the possible relation between globular clusters and stars of high velocity. He showed that both objects exhibit the same peculiar distribution with regard to the Milky Way and adduces other evidence indicating an intimate relation between the two classes of objects. He has also studied the difference in velocity between absolutely bright and absolutely faint stars. He shows that most of this difference disappears if we exclude the small group of stars of exceptionally high velocity. Both these papers have been published in the *Proceedings of the National Academy of Sciences.*

Mr. Schlesinger has examined those cases of binary stars for which so-called spectroscopic parallaxes have been derived for both components, has shown that these objects indicate a relation between such parallaxes and mass. An abstract of this paper appears in the *Publications of the American Astronomical Society.*

The 26-inch Photographic Refractor. In pursuance of the plan described in last year's report the Observatory has undertaken the construction in its own shop of the mounting for a 26-inch photographic refractor. The actual construction was begun early in the year, following detailed drawings prepared by Mr. Sellew. It was found desir-

able to install several large machine tools to supplement the regular equipment of the Observatory shop; but even with these additions some of the larger parts could not be handled by us and have been assigned to outside firms. Most of the construction is now finished. (Actually completed in October, 1924.) It is planned to make a complete assembly of the telescope in the Mason Mechanical Laboratory of the University.

Very fortunately the Observatory entered an order for the 26-inch lens intended for this telescope some time before it was absolutely necessary to do so. The lens was finished by Mr. McDowell in September, 1923, a few weeks before his sudden death. It is the last work of this famous optician, and letters from him declare it to be his best. Tests made by the writer and others in the optical shop of the maker indicate very clearly that the glass is a good one; the exact degree of its excellence cannot be definitely ascertained until it is tested with actual star images, and no opportunity for doing this will be forthcoming until the telescope is mounted at its site in the southern hemisphere.

At its annual meeting, April 14, the Observatory Committee, acting upon the recommendation of the director, decided to accept one of several invitations extended to us by organizations in South Africa. Two of these, at Johannesburg and Bloemfontein respectively, are especially attractive and the astronomical conditions at both places are known to be exceptionally good. Indeed, several competent astronomers who have investigated the district at first hand have expressed the opinion that the astronomical conditions on the Veldt, upon which both of these cities are situate, are not excelled at any other known locality either north or south of the equator. It is not necessary to make a decision as to the exact location of the telescope until next winter. The director intends to sail for South Africa on December 13, taking with him the objective, the mounting to follow soon after. He expects to be able to recommend one or the other of these two sites after an inspection of at most two weeks, and to begin the erection of the telescope as soon thereafter as the circumstances permit.

FRANK SCHLESINGER, *Director.*

YERKES OBSERVATORY
UNIVERSITY OF CHICAGO
WILLIAMS BAY, WISCONSIN

Personnel. Changes in the permanent staff since the last report were as follows: Dr. Otto Struve was advanced from an assistantship to an instructorship from January 1, 1924. In June, 1924, Dr. Frank E. Ross, for the past nine years at the Eastman Research Laboratory, was appointed associate professor of practical astronomy, effective on October 1, 1924.

Equipment. During this fiscal year the University of Chicago came into possession of the valuable property bequeathed to it by Professor Barnard, as a memorial to his wife, Rhoda Calvert Barnard, consisting of his home and ample grounds, adjacent to the Observatory. The Barnard House will be occupied by Professor Ross and family.

Trouble had been developing in the roller bearings of the wheels carrying the great dome and during the winter each one of the twenty-six wheels was taken down by Messrs. Sullivan and Ridell, as circumstances permitted, and repaired. Plans have been adopted for the renewal of these bearings within the next year or two.

A new metallic exposing shutter and several aluminum plateholders were made by Mr. Ridell for the 12-inch telescope. He also overhauled some parts of the Rumford spectroheliograph, beside making many other repairs and betterments.

Weather Conditions. The year was a very poor one for night observing, as would appear from the following table:

HOURS OF OBSERVATION WITH 40-INCH TELESCOPE.

		20-Year Normal	
	1923-24	1903-22	Departure
July	119	151	—32
Aug.	122	156	—34
Sept.	130	159	—29
Oct.	175	170	+ 5
Nov.	101	140	—39
Dec.	102	132	—30
Jan.	130	140	—10
Feb.	75	129	—54
Mar.	107	133	—26
Apr.	113	120	— 7
May	74	120	—46
June	71	126	—55
	1319	1676	—357

We shall probably find the above normals too high in future as Professor Barnard was accustomed to observe even under conditions of poor seeing. It is not our present practice to take photographs or observe with the 40-inch telescope under unfavorable conditions, so that this will have a considerable effect on the hours of observation.

The main programs of work continued as during the previous year, except for the expedition for observing the total solar eclipse of September 10, 1923.

Solar Work. Fewer plates than usual were taken by Mr. Lee with the Rumford spectroheliograph, because of the feeble activity of the sun and the cloudy skies. He used the "Scout" spectroscope on suitable occasions for visual reconnaissance for prominences, but found none of special interest. Thirty-two plates of the disk and sixty-two of prominences were taken. Of these, thirteen and eighteen plates, respectively, were taken by Mr. Struve around the time of the solar eclipse, in Mr. Lee's absence.

With the 12-inch telescope, 111 direct photographs of the sun were taken on 51 days, chiefly by Miss Calvert.

Observations with the 40-inch Telescope. Micrometric. Mr. Van Biesbroeck made 1234 measures of double stars, of the list discovered by Hussey (98 per cent of which have now been re-observed), of rapid binaries, or of neglected stars. He also made observations of faint comets for position, brightness and physical appearance, on fifteen nights; of asteroids, on eighteen; of comparison stars, on thirty-six, and of faint variable stars, on twenty-three. The satellites of Saturn, Uranus, and Neptune were measured on respectively six, four, and thirteen nights. The stellar interferometer was used occasionally to test a new device, built by Mr. H. H. Porter of Chicago, for eliminating the effect of atmospheric dispersion.

Astrometric. 243 plates for stellar parallax were obtained, 238 by Mr. Lee, assisted by Mr. Sullivan, and 5 by Mr. Van Biesbroeck; and seven determinations of parallax were completed by Mr. Lee.

Four Selected Areas have been measured by Mr. Lee, and reduced, completing the zone at 45 degrees of north declination, with its 24 Kapteyn Areas. This work has included more than 350,000 settings on stellar images and scale. The individual trigonometric parallaxes and the proper motions of 1041 stars have been derived by a general method. The tables, charts, and discussions are being prepared for publication.

Photometric. On parts of 39 nights, Mr. Parkhurst obtained with the objective-grating seven plates of Rumford fields for comparison of photo-visual with visual magnitudes from the equalizing-wedge photometer. He also took two plates of the suspected variable BM Orionis (Bond 624). He made 145 visual comparisons of 37 variable stars, usually between 14th and 17th magnitudes; and on one night used the equalizing-wedge photometer on the Polar Sequence and on the comparison stars for RR Virginis.

Spectrographic. The Bruce spectrograph was employed exclusively with one prism and with the new Ross camera lens, and chiefly for stars of classes A and B. 307 plates were obtained by Mr. Barrett and 351 by Mr. Struve, Mr. Sullivan generally assisting, bringing the total number of such plates to 7431. 357 spectrograms were measured by Mr. Struve, many of the results being included in his doctor's thesis, "A Study of Spectroscopic Binaries of Short Period," presented in December, 1923. The orbits of 61 μ Orionis, of 43 θ^2 Orionis, and of 2 Monocerotis were definitively completed. Numerous plates of three spectroscopic binaries were loaned for measurement to Dr. Otto Kohl of Goettingen, who published an orbit of 13 μ Sagittarii, confirming our early results from the same material and indicating a variable motion of the system from the recent spectrograms.

24-inch Reflector. On parts of 37 nights, Mr. Parkhurst obtained for photometric purposes 32 plates of Rumford fields, 19 of the Polar

Sequence, 3 of the Kapteyn Areas, and one of the Orion nebula.

Mr. Van Biesbroeck photographed 26 fields for the position and physical appearance of comets. With Mr. Struve, he continued observations on asteroids fainter than magnitude 13.8. Positions for 74 asteroids were published in the *Astronomical Journal*. Ten of these were followed for a considerable arc, to establish their identity. Eight of them appear to be new.

12-inch Refractor. On parts of fourteen nights, Mr. Parkhurst made two complete sets of measures, with the equalizing-wedge photometer, of ten Rumford fields, for the comparison of the standard stars of the 9th with those of the 12th magnitude.

The instrument was also employed for incidental observations with the solar spectroscope, and for academic visitors on numerous occasions.

The *Zeiss U.-V. Doublet* was taken to California for the eclipse, and re-installed later in the autumn.

The *Bruce Photographic Telescope* was only slightly used, due to lack of an observer, but in the coming year will be kept in regular operation by Mr. Ross.

Mr. W. R. Paul, of Chicago, swept with the *6-inch Comet-Seeker* on parts of 17 nights.

Eclipse Expedition. During the summer and autumn of 1923, several members of the staff were much occupied with preparations for the total solar eclipse of September 10, entailing an absence from the Observatory of Mr. Lee from July 26 to September 30, of Mr. Parkhurst from August 9 to October 3, and of Mr. Frost from August 21 to September 22. An account of this expedition, which was generously financed by Mr. William Wrigley, Jr., of Chicago and Santa Catalina, was published by the writer in *Popular Astronomy* for April, 1924.

Miss Calvert continued work on the preparation of the late Professor Barnard's Atlas of the Milky Way, under the direct supervision of the writer. This is to be published by the Carnegie Institution at Washington, in 1925. She also was occupied in preparing Professor Barnard's bibliography for a biographical sketch by the writer, which will appear in the *Memoirs of the National Academy of Sciences*. She further continued the reduction of unpublished observations by Professor Barnard, which were requested by persons working in different fields.

The reduction of Professor Barnard's extensive observations of the clusters was continued by one computer under the supervision of Mr. Van Biesbroeck.

The Library. The Observatory received, by Mr. Barnard's bequest, 321 bound and 884 unbound volumes, besides many reprints and pamphlets. There were also added 233 bound and 36 unbound volumes, and many pamphlets, bringing the total up to 7149 bound and 2445 unbound volumes, and 4160 pamphlets (exclusive of those received from the Barnard Estate).

Visitors to the number of 13,124 were counted on the public Saturday afternoons. Their movement was much facilitated by an additional iron stairway in the great dome.

Volumes 58 and 59 of the *Astrophysical Journal* were issued.

EDWIN B. FROST, *Director.*

ORION.

What mighty force in thee doth cause
(At night when I am homeward bound)
My soul to thrill, my heart to pause?
Methinks wouldst have me leave the ground
To join thee at thy source of light—
So doth compel thy wondrous sight!

Thou hast of beauty goodly store,
Nor noble mien nor poise dost need;
Of order one could ill ask more,
Thou art delight to every creed.
Withal great charm to me dost send
In that thou art most faithful friend!

As men to men themselves unite
Now to condole, now to rejoice
With them whom Time doth lift or smite:—
Dost thou to me lend thy sweet voice
As need there be—regret or cheer—
Let no one say thou art not near!

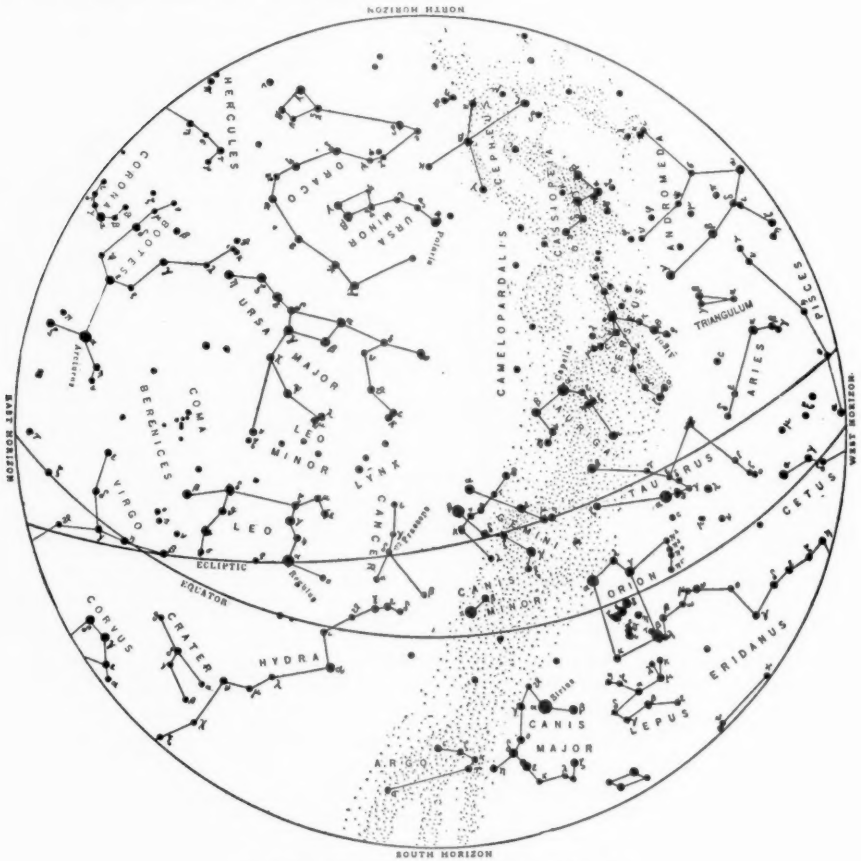
What sympathy in Betel's fire
With soothing softness so replete!
What courage Rigel doth inspire,
Of boundless light, resplendent seat!
What faithfulness and loyalty
Orion's girdle, steadfast three!

O, stellar Friend! The God above
Has seen it best to make of thee
Rare symbol of His constant love,
That mightst with man thru gloomy sea
Commune: behold then what doth cause
My soul to thrill, my heart to pause!

JOHN ALEXANDER PRETI.

PLANET NOTES FOR MARCH.

The *Sun* will continue its motion northeastward from $22^h\,46^m$, $-7°\,51'$ on March 1 to $0^h\,36^m$, $+3°\,52'$ on March 31. It will cross the equator about three A. M., Greenwich Civil Time, on March 21. This marks the moment of vernal equinox and the beginning of spring. On this date the day and night are equal at all places on the earth and after this date the days will be longer than the nights in the northern hemisphere.



THE CONSTELLATIONS AT 9:00 P. M. MARCH 1.

The phases of the *Moon* will occur as follows:

First Quarter	March	2	at 6 A.M.	C.S.T.
Full Moon	"	10	" 2 P.M.	"
Last Quarter	"	17	" 5 P.M.	"
New Moon	"	24	" 2 P.M.	"

The moon will be nearest the earth for the month on March 20 and farthest from the earth on March 4.

Mercury will be moving eastward throughout the month. It will pass the sun on the opposite side from the earth on March 5. On March 31 it will reach a point of greatest elongation east of the sun. At this time it will be more than an hour east of and about 10° north of the sun. This will therefore be a favorable elongation for observers in the northern hemisphere. At this time the planet will be near the boundary between Pisces and Aries, a short distance southwest of α and β Arietis.

Venus will remain near the sun during this and the following months. It will be a short distance west of the sun. During the month it will move about 30 minutes nearer the sun.

Mars will be only a few hours east of the sun. It will, however, still be visible in the western sky after sunset. It will continue to move farther from the earth throughout the month.

Jupiter will be near the meridian at sunrise during the month. It will be moving northward slowly.

Saturn will be well situated for morning observations. It will cross the meridian a little after three A. M. at the middle of the month, and earlier from day to day.

Uranus will be in conjunction with the sun on March 12 and consequently will not be visible during this month.

Neptune will be very well situated during this month. It will cross the meridian a little before midnight. It will be in the western part of the constellation Leo.

Occultations Visible at Washington.

[*From the American Ephemeris*]

Date 1925	Star's Name	Magnitude	IMMERSION. Washington C.T.	IMMERSION. Angle from N	EMERSION. Washington C.T.	EMERSION. Angle from N	Duration
			h m	°	h m	°	h m
Mar. 1	75 Tauri	5.2	23 15	126	0 1	223	0 46
3	64 Orionis	5.1	19 55	48	21 6	307	1 11
8	7 Leonis	6.2	2 16	102	3 21	300	1 6
8	11 Leonis	6.5	3 32	59	4 10	340	0 38
10	*b* Virginis	5.2	22 28	85	23 26	331	1 9
13	88 Virginis	6.5	4 8	146	5 15	265	1 7
15	γ Librae	4.0	3 36	92	4 53	312	1 17

VARIABLE STARS.

Long Period Variables. — In Harvard College Observatory Circular 272, Mr. Leon Campbell gives predicted times of maxima and minima of the long period variable stars. These predictions will be very useful to observers of the stars which go below the limits of their telescopes at minima, enabling the observers to avoid wasting their time looking for that which cannot be seen.

Minima of Variable Stars of Short Period.

[Calculated by members of the classes in Astronomy at Carleton College.]

Given to the nearest hour in Greenwich civil time; to obtain Eastern Standard time subtract 5^h; Central Standard time 6^h, etc.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich civil times of minima in 1925 March							
	h m	° ′		d h	d h	d h	d h	d h	d h	d h	d h	d h
SY Androm.	0 08.0	+43 09	9.5—13.0	34 21.8			10 3					
RT Sculptor.	31.5	—26 13	9.6—10.5	0 12.3	1 8		9 0		16 17		24 9	
U Cephei	0 52.4	+81 20	7.0— 9.0	1 11.8	4 6		11 17		19 5		26 16	
Z Persei	2 33.7	+41 46	9.4—12	3 01.4	3 16		9 18		22 0		27 2	
TW Cassiop.	37.6	+65 19	8.2— 9.0	1 10.3	6 6		14 20		23 10		31 23	
RY Persei	39.0	+47 43	8.0—10.3	6 20.7	3 21		10 18		24 11		31 8	
RZ Cassiop.	39.9	+69 13	6.9— 8.1	1 04.7	4 7		11 11		18 15		25 19	
TX Cassiop.	44.4	+62 22	9.4—10.1	2 22.2	9 6		18 1		26 19			
ST Persei	53.7	+38 47	8.5—10.5	2 15.6	6 13		14 12		22 10		30 9	
RX Cassiop.	2 58.8	+67 11	8.6— 9.1	32 07.6							23 5	
Algol	3 01.7	+40 34	2.3— 3.5	2 20.8	7 9		16 0		24 14			
RT Persei	16.7	+46 12	9.5—11.5	0 20.4	5 19		12 14		19 9		26 4	
λ Tauri	55.1	+12 12	3.3— 4.2	3 22.9	1 4		9 2		16 23		24 21	
RW Tauri	3 57.8	+27 51	7.1— [11	2 18.5	2 13		10 20		19 4		27 11	
RV Persei	4 04.2	+33 59	9.5—11.0	1 23.4	1 2		8 23		16 21		24 18	
RW Persei	13.3	+42 04	8.8—11.0	13 04.8	5 20				19 1			
SZ Tauri	31.4	+18 20	7.2— 7.7	3 03.6	2 7		8 14		21 4		27 11	
RS Cephei	4 48.6	+80 06	9.5—12.0	12 10.1			10 14		23 1			
TT Aurigae	5 02.8	+39 27	7.8— 8.7	0 16.0	3 8		10 1		23 8		30 1	
RY Aurigae	11.5	+38 13	10.7—11.7	2 17.5	6 4		14 8		22 13		30 17	
RZ Aurigae	42.9	+31 40	10.6—13.3	3 00.3	5 14		11 15		23 16		29 16	
SV Tauri	45.8	+28 05	9.4—11.0	2 04.0	3 18		12 10		21 2		29 18	
Z Orionis	50.2	+13 40	9.7—10.7	5 04.9	2 20		13 6		23 15			
SV Gemin.	54.6	+24 28	9.8— [11	4 00.2	5 8		13 8		21 9		29 9	
RW Gemin.	5 55.4	+23 08	9.5—11.0	2 20.8	1 20		13 7		19 1		30 12	
U Columbæ	6 11.2	—33 03	9.2—10.0	2 19.2	3 22		15 3		20 17		31 22	
SX Gemin.	22.0	+20 37	10.8—11.5	1 08.8	2 10		10 14		18 19		27 0	
RW Monoc.	29.3	+ 8 54	9.0—10.8	1 21.7	5 6		12 22		20 12		28 3	
RX Gemin.	43.6	+33 21	8.8— 9.6	12 05.0			11 8				23 13	
RU Monoc.	6 49.4	— 7 28	9.8—10.5	0 21.5	1 15		8 19		23 3		30 7	
R Can. Maj.	7 14.9	—16 12	5.8— 6.4	1 03.3	6 1		13 12		20 8		27 4	
RY Gemin.	21.7	+15 52	8.9— [10	9 07.2	9 6		18 13		27 21			
Y Camelop.	27.6	+76 17	9.5—12	3 07.3	3 20		10 11		23 16		30 7	
TX Gemin.	30.3	+17 08	10.0—11.9	2 19.2	7 0		15 10		23 19			
RR Puppis	43.5	—41 08	9.4—10.7	6 10.3	7 0		13 11		19 21		26 7	
V Puppis	7 55.4	—48 58	4.1— 4.8	1 10.9	3 23		11 6		18 13		25 19	
X Carinae	8 29.1	—58 53	7.9— 8.7	0 13.0	3 4		11 7		19 10		27 13	
S Cancri	8 38.2	+19 24	8.2—10	9 11.6	9 9		18 20		28 8			
RX Hydrae	9 00.8	— 7 52	9.1—10.5	2 06.8	4 13		11 9		25 2		31 22	
S Velorum	29.4	—44 46	7.8— 9.3	5 22.4	2 18		8 16		20 13		26 12	
Y Leonis	9 31.1	+26 41	9.3—11.2	1 16.5	2 13		9 7		22 18		29 12	
RR Velorum	10 17.8	—41 36	10.0—10.9	1 20.5	5 5		12 15		20 1		27 11	
SS Carinæ	10 54.2	—61 23	12.2—12.8	3 07.2	5 3		11 17		24 22		31 13	
ST Urs. Maj.	11 22.4	+45 44	6.7— 7.2	8 19.2	3 12		12 7		21 2		29 21	
RW Urs. Maj.	35.4	+52 34	10.3—11.4	7 07.9	3 1		10 9		17 17		25 1	
Z Draconis	11 39.8	+72 49	9.9—13.6	1 08.6	2 10		9 5		22 19		29 14	
RZ Centauri	12 55.6	—64 05	8.5— 8.9	1 21.0	6 8		13 21		21 9		28 21	
RS Can. Ven	13 06.3	+36 28	7.5—12.5	4 19.1	3 4		12 19		22 9		31 23	
SS Centauri	07.2	—63 37	8.8—10.4	2 11.3	6 6		13 16		21 2		28 13	
SX Hydræ	13 39.0	—26 23	8.6—12.7	2 21.5	3 19		9 14		21 4		26 23	

Minima of Variable Stars of Short Period—Continued.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich civil times of minima in 1925 March							
	h m	° ′		d h	d h	d h	d h	d h	d h	d h	d h	d h
δ Libræ	14 55.6	— 8 07	4.8— 6.2	2 07.9	4 7	11 7	18 6	25 6				
U Coronæ	15 14.1	+32 01	7.6— 8.7	3 10.9	2 4	9 1	22 21	29 19				
TW Draconis	15 32.4	+64 14	7.3— 8.9	2 19.4	4 1	12 12	20 22	29 8				
SS Libræ	15 43.4	—15 14	9.3—11.5	0 18.4	3 10	10 15	17 19	25 0				
SW Ophiuchi	16 11.1	— 6 44	9.2—10.0	2 10.7	7 16	15 0	22 8	29 16				
SX Ophiuchi	12.6	— 6 25	10.5—11.2	2 01.5	4 5	12 11	20 17	28 23				
R Aræ	31.1	—56 48	6.8— 7.9	4 10.2	2 7	11 4	20 1	28 21				
TT Herculis	16 49.9	+17 00	8.9— 9.3	20 18.1	4 2		24 21					
TU Herculis	17 09.8	+30 50	9.5—12	2 06.4	6 9	13 4	19 23	26 18				
U Ophiuchi	11.5	+ 1 19	6.0— 6.7	0 20.1	8 7	16 16	25 2					
u Herculis	13.6	+33 12	4.6— 5.4	2 01.2	5 22	12 1	24 9	30 12				
TX Herculis	15.4	+42 00	8.3— 9.0	1 00.7	2 3	8 7	20 16	26 20				
RV Ophiuchi	29.8	+ 7 19	9. —12	3 16.5	1 18	9 3	23 21	31 6				
SZ Herculis	36.0	+33 01	9.5—10.3	0 19.6	5 6	13 10	21 15	29 19				
TX Scorpii	48.6	—34 13	7.5— 8.2	0 22.6	7 9	14 22	22 11	30 0				
UX Herculis	49.7	+16 57	8.8—10.5	1 13.2	2 4	9 22	17 16	25 10				
Z Herculis	53.6	+15 09	7.1— 7.9	3 23.8	4 18	12 17	20 17	28 17				
WX Sagittarii	53.6	—17 24	9.2—10 8	2 03.1	4 16	13 4	21 16	30 5				
WY Sagittarii	17 54.9	—23 01	9.5—10.6	4 16.0	3 10	12 18	17 11	26 19				
SX Draconis	18 03.0	+58 23	9.3—10.5	5 04.1	5 1	15 9	20 13	30 21				
RS Sagittarii	11.0	—34 08	5.9— 6.3	2 10.0	7 18	15 0	22 5	29 11				
V Serpentis	11.1	—15 34	9.5—11.1	3 10.9	7 16	14 14	21 12	28 10				
RZ Scuti	21.1	— 9 15	7.4— 8.3	15 03.2		14 21		30 1				
RZ Draconis	21.8	+58 50	9.5—10.2	0 13.2	5 11	16 15	19 18	26 22				
RX Herculis	26.0	+12 32	7.0— 7.6	0 21.3	9 8	16 11	22 14	30 16				
SX Sagittarii	39.7	—30 36	8.7— 9.8	2 01.8	7 22	16 5	24 12					
RR Draconis	40.8	+62 34	9.3—13	2 19.9	2 12	11 1	19 12	28 0				
RS Scuti	43.7	—10 21	9.3—10.3	0 15.9	4 8	10 21	24 7	30 22				
β Lyræ	46.4	+33 15	3.4— 4.1	12 21.8	3 12	16 10	29 8					
U Scuti	18 48.9	—12 44	9.1— 9.6	0 22.9	8 6	15 22	23 13	31 4				
RX Draconis	19 01.1	+58 35	9.3—10.2	1 21.4	6 3	13 16	21 6	28 20				
RV Lyræ	12.5	+32 15	11. —12.8	3 14.4	7 6	14 10	21 15	28 20				
RS Vulpec.	13.4	+22 16	6.9— 8.0	4 11.4	6 3	15 2	24 1					
U Sagittæ	14.4	+19 26	6.5— 9.0	3 09.1	3 6	10 1	23 13	30 8				
Z Vulpec.	17.5	+25 23	7.3— 8.5	2 10.9	1 23	9 8	24 1	31 10				
TT Lyræ	24.3	+41 30	9.4—11.6	5 05.8	1 17	12 5	17 11	27 22				
UZ Draconis	26.1	+68 44	9.0— 9.8	1 15.1	2 8	8 20	21 22	28 10				
SY Cygni	19 42.7	+32 28	10. —12	6 00.2	2 0	8 0	20 1	26 1				
WW Cygni	20 00.6	+41 18	9.3—13.4	3 07.6	1 2	7 18	21 0	27 15				
SW Cygni	03.8	+46 01	9. —11.7	4 13.8	2 4	11 7	20 11	29 14				
VW Cygni	11.4	+34 12	9.8—11.8	8 10.3	4 15	13 1	21 12	29 22				
RW Capric.	12.2	—17 59	8.8—10.6	3 09.4	6 15	13 9	20 4	26 23				
UW Cygni	19.6	+42 55	10.5—13	3 10.8	1 1	7 23	21 18	28 16				
V Vulpec	32.3	+26 15	8.2— 9.8	37 19.0			24 10					
W Delphini	33.1	+17 56	9.4—12.1	4 19.4		10 3	19 18	29 8				
RR Delphini	38.9	+13 35	10.5—11.8	4 14.4	3 21	13 2	22 7	31 12				
Y Cygni	48.1	+34 17	7.1— 7.9	1 12.0	3 19	12 18	21 18	30 18				
WZ Cygni	49.3	+38 27	9.9—10.8	0 14.0	7 18	15 8	22 23	30 13				
RR Vulpec	20 50.5	+27 32	9.6—11.0	5 01.2	3 1	13 4	23 6					
RY Aquarii	21 14.8	—11 14	8.8—10.4	1 23.2	8 1	15 22	23 18	31 15				
UZ Cygni	55.2	+43 52	8.9—11.6	31 07.3		17 10						
RT Lacertæ	21 57.4	+43 24	9.1—10.5	5 01.7	3 12	13 16	23 19					
RW Lacertæ	22 40.6	+49 08	10.2—11.2	5 04.4	6 13	11 14	21 16	26 17				
VW Pegasi	51.7	+32 42	10.0—10.6	5 06.4	1 7	11 20	17 2	27 15				
Y Piscium	23 29.3	+ 7 22	9.0—12.0	3 18.4	9 7	16 20	24 9	31 22				
TW Androm.	23 58.2	+32 17	8.6—11.5	4 02.9	6 2	14 8	22 14	30 20				

Maxima of Variable Stars of Short Period.

[Calculated by members of the classes in Astronomy at Carleton College.]

Given to the nearest hour in Greenwich civil time; to obtain Eastern Standard time subtract 5h; Central Standard time 6h, etc.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich civil times of maxima in 1925 March					
	h m	° ′		d h	d h	d h	d h	d h	d h	d h
SX Cassiop.	0 05.5	+54 20	8.6— 9.2	36 13.7					29	3
SY Cassiop.	0 09.8	+57 52	9.3— 9.9	4 01.7	4 0	12 3	20 7		28	10
RR Ceti	1 27.0	+ 0 50	8.3— 9.0	0 13.3	3 11	11 5	18 23		26	16
RW Cassiop.	1 30.7	+57 15	8.9—11.0	14 19.2	1 10	16 5	31 0			
V Arietis	2 09.6	+11 46	8.3— 9.0	0 23.8	2 14	10 12	18 11		26	9
SU Cassiop.	2 43.0	+68 28	6.5— 7.0	1 22.8	2 5	10 1	17 20		25	15
RW Camelop.	3 46.2	+58 21	8.2— 9.4	16 00.0		11 21			28	7
SX Persei	4 10.2	+41 27	10.4—11.2	4 07.0	2 11	11 1	19 14		28	4
SV Persei	42.8	+42 07	8.8— 9.6	11 03.1	9 2	20 5	31 8			
RX Aurigæ	4 54.5	+39 49	7.2— 8.1	11 15.0		12 5	23 20			
SX Aurigæ	5 04.6	+42 02	8.0— 8.7	1 12.8	1 4	8 19	24 4		31	19
SY Aurigæ	05.5	+42 41	8.4— 9.5	10 03.3		10 8	20 12		30	15
Y Aurigæ	21.5	+42 21	8.6— 9.6	3 20.6	2 20	10 13	18 7		26	0
RZ Gemin.	5 56.6	+22 15	9.1—10.0	5 12.7	3 17	14 19	20 8		31	9
RS Orionis	6 16.5	+14 44	8.2— 8.9	7 13.6	4 20	12 10	20 0		27	13
T Monoc.	19.8	+ 7 08	5.7— 6.8	27 00.3		10 3				
R Aurigæ	23.0	+30 33	5.1— 6.0	3 17.5	2 13	10 0	17 11		24	22
W Gemin.	29.2	+15 24	6.7— 7.5	7 22.0	4 17	12 15	20 13		28	11
ζ Gemin.	6 58.2	+20 43	3.7— 4.3	10 03.7	4 12	14 16	24 20			
RU Camelop	7 10.9	+69 51	8.5— 9.8	22 06.5	2 10		24 17			
RR Gemin.	7 15.2	+31 04	10.0—11.5	0 09.5	3 8	11 7	19 6		27	4
V Carinae	8 26.7	—59 47	7.4— 8.1	6 16.7	2 23	9 16	23 1		29	18
T Velorum	8 34.4	—47 01	7.6— 8.5	4 15.3	3 13	12 20	22 2		31	11
V Velorum	9 19.2	—55 32	7.5— 8.2	4 08.9	8 12	17 6	25 23			
Z Leonis	9 46.4	+27 22	7.9— 9.6	56 08.7						
RR Leonis	10 02.1	+24 29	9.1—10.1	0 10.9	6 1	12 19	19 14		26	9
SU Draconis	11 32.2	+67 53	8.9— 9.6	0 15.8	9 13	16 4	22 18		29	9
S Muscae	12 07.4	—69 36	6.4— 7.3	9 15.8	3 9	10 1	22 17			
SW Draconis	12.8	+70 04	8.8— 9.6	0 13.7	2 1	10 1	18 0		26	0
T Crucis	15.9	—61 44	6.8— 7.6	6 17.6	8 7	15 0	21 18		28	11
R Crucis	18.1	—61 04	6.8— 7.9	5 19.8	3 14	9 10	21 2		26	21
S Crucis	12 48.4	—57 53	6.5— 7.6	4 16.6	4 22	14 7	19 0		28	15
W Virginis	13 20.9	— 2 52	8.7—10.4	17 06.5	1 7		18 13			
SS Hydræ	25.0	—23 08	7.4— 8.1	8 04.8	8 3	16 7	24 12			
RV Urs. Maj.	13 29.4	+54 31	9.2— 9.9	0 11.2	5 20	12 21	19 21		26	21
ST Virginis	14 22.5	— 0 27	10.3—11.4	0 09.9	2 3	9 13	24 8		31	18
V Centauri	25.4	—56 27	6.4— 7.8	5 11.9	1 21	12 21	18 9		29	9
RS Bootis	29.3	+32 11	8.9—10.0	0 09.1	3 20	11 9	18 22		26	11
R Triang.Austr.	15 10.8	—66 08	6.7— 7.4	3 09.3	3 22	10 16	24 6		31	0
S Triang.Austr.	15 52.2	—63 29	6.4— 7.4	6 07.8	1 9	7 17	20 8		26	16
S Normæ	16 10.6	—57 39	6.6— 7.6	9 18.1	6 19	16 13	26 7			
RW Draconis	33.7	+58 03	9.6—10.8	0 10.6	1 7	10 4	19 6		27	21
RV Scorpii	16 51.8	—33 27	6.7— 7.4	6 01.5	1 19	12 22	18 23		31	2
X Sagittarii	17 41.3	—27 48	4.4— 5.0	7 00.3	9 23	16 23	24 0		31	0
Y Ophiuchi	47.3	— 6 07	6.1— 6.5	17 02.9		13 5			30	8
W Sagittarii	17 58.6	—29 35	4.3— 5.1	7 14.3	3 13	11 4	18 18		26	8
Y Sagittarii	18 15.5	—18 54	5.4— 6.2	5 18.6	6 0	11 19	23 8		29	2
U Sagittarii	26.0	—19 12	6.5— 7.3	6 17.9	6 11	13 5	19 23		26	17
Y Scuti	32.6	— 8 27	8.7— 9.2	10 08.3		12 21	23 5			
RZ Lyræ	39.9	+32 42	9.9—11.2	0 12 3	7 22	14 14	22 6		30	22
RT Scuti	18 44.1	—10 30	9.1— 9.7	0 11.9	2 14	10 0	17 10		24	21
κ Pavonis	18 46.6	—67 22	3.8— 5.2	9 02.2	2 12	11 14	20 16		29	19
U Aquilæ	19 24.0	— 7 15	6.2— 6.9	7 00.6	1 13	8 14	22 15		29	15

Maxima of Variable Stars of Short Period—Continued.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich civil times of maxima in 1925 March					
	h m	° ′		d h	d h	d h	d h	d h	d h	d h
XZ Cygni	19 30.4	+56 10	8.6— 9.3	0 11.2	2 6	9 6	23 6	30 6		
U Vulpec.	32.2	+20 07	6.5— 7.6	7 23.5	5 16	13 16	21 15	29 15		
SU Cygni	40.8	+29 01	6.2— 7.0	3 20.3	7 7	15 0	22 16	30 9		
η Aquilæ	47.4	+ 0 45	3.7— 4.5	7 04.2	4 12	11 16	18 20	26 1		
S Sagittæ	51.5	+16 22	5.6— 6.4	8 09.2	3 3	11 12	19 21	28 6		
X Vulpec.	19 53.3	+26 17	9.5—10.5	6 07.7	3 6	9 14	22 5	28 13		
X Cygni	20 39.5	+35 14	6.0— 7.0	16 09.3	7 2		23 12			
T Vulpec.	47.2	+27 52	5.5— 6.1	4 10.5	1 19	10 16	19 13	28 10		
UY Cygni	52.3	+30 03	9.6—10.4	0 13.5	7 8	14 1	20 19	27 12		
RV Capric.	55.9	—15 37	9.2—10.1	0 10.7	6 7	13 0	19 17	26 10		
TX Cygni	20 56.4	+42 12	8.5— 9.7	14 17.4	8 22		23 14			
VY Cygni	21 00.4	+39 34	8.8— 9.5	7 20.6	5 0	12 21	20 17	28 14		
SW Aquarii	10.2	— 0 20	9.9—10.8	0 11.0	5 12	12 10	19 7	26 4		
VZ Cygni	21 47.7	+42 40	8.2— 9.2	4 20.7	2 8	12 1	21 19	31 12		
Y Lacertæ	22 05.2	+50 33	9.1— 9.6	4 07.8	6 20	15 11	24 3			
δ Cephei	25.5	+57 54	3.7— 4.6	5 08.8	1 5	11 22	17 7	28 0		
Z Lacertæ	36.9	+56 18	8.2— 9.0	10 21.1	5 13	12 11	27 8			
RR Lacertæ	37.5	+55 55	8.5— 9.2	6 10.1	1 18	8 4	21 0	27 9		
V Lacertæ	44.5	+55 48	8.5— 9.5	4 23.6	2 1	12 0	21 23	31 23		
X Lacertæ	22 45.0	+55 54	8.2— 8.6	5 10.7	5 12	10 22	21 20	27 6		
SW Cassiop.	23 03.7	+58 11	9.2— 9.7	5 10.6	2 14	13 3	18 22	29 19		
RS Cassiop.	32.6	+61 52	9.0—11.0	6 07.1	5 14	11 21	24 11	30 19		
RY Cassiop.	47.2	+58 11	9.3—11.8	12 03.4	1 16	13 20	25 23			
V Cephei	23 51.7	+82 38	6.0— 7.0	0 23.9	2 22	9 21	23 20	30 20		

Monthly Report of the American Association of Variable Star Observers, Received During December, 1924.

We are slowly but surely adding new members to our ranks and among these are some very promising observers, which is much to be desired. The following have been recently elected to annual membership in the Association:

George E. Jones, Mussoorie, U. P. India.
Samuel L. Boothroyd, Cornell University, Ithaca, N. Y.
Winifred Kearons, Fall River, Mass.

Mr. P. M. Millman of Kobe Shigai, Japan, has joined as a Life Member. To all of them, we extend a cordial welcome to our activities. Mr. Robert W. Pomeroy of Buffalo, N. Y., has made a very substantial contribution to the Edward C. Pickering Memorial Fund, and has been elected a Patron of the Association.

The Pickering Memorial is making steady progress and, with the authority of the Council, a small part of the interest of this fund is being used to defray the expense of preparing the monthly reports. Thus the purpose of the Memorial is already being partly realized.

We are indebted to Messrs. Brocchi and Skaggs for their generosity in providing Julian Day Calendars for the current year, and to the former, especially, for the excellent and very useful tables which he has supplied for converting local Standard time directly into Greenwich Civil tenths of a day. If you have not already received copies of these, please notify the undersigned at once.

VARIABLE STAR OBSERVATIONS RECEIVED DURING DECEMBER, 1924.

Oct. 0 = J. D. 2424059 Nov. 0 = J. D. 2424090 Dec. 0 = J. D. 2424120

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
000339 V SCULPTORIS—						
	4069.9	9.6	Bl	4088.0	10.3	Bl
	4078.0	9.8	Bl			
001032 S SCULPTORIS—						
	4036.3	8.9	Kk	4078.0	7.9	Bl
	4056.2	8.6	Kk	4081.3	7.9	Sm
	4060.0	8.6	Kk	4084.0	7.5	Kk
	4060.3	8.9	Sm	4088.0	7.7	Bl
	4069.9	7.9	Bl	4118.6	6.7	Pt
001046 X ANDROMEDAE—						
	4107.7	10.7	B	4127.6	11.8	Br
	4120.7	11.8	Lv	4130.6	11.7	Ie
001620 T CETI—						
	4036.0	6.1	Kk	4069.0	6.4	Kk
	4046.1	6.2	Kk	4073.9	6.3	Kk
	4048.2	6.4	Kk	4081.0	6.3	Kk
	4051.1	6.4	Kk	4084.0	6.3	Kk
	4056.2	6.5	Kk	4085.0	6.3	Kk
	4060.0	6.4	Kk	4088.0	6.5	Kk
001726 T ANDROMEDAE—						
	4075.1	9.3	Ch	4121.5	8.2	Mz
	4087.0	9.2	Ch	4121.7	8.0	Lv
	4117.5	7.8	Pt	4124.6	7.9	Ie
	4117.5	7.9	Mz	4132.6	7.9	B
	4119.6	7.9	B	4133.6	8.2	Lv
001755 — CASSIOPEIAE—						
	4117.5	7.5	Mz	4129.6	7.2	Al
	4117.5	7.4	Pt	4130.6	7.6	Ie
	4124.6	7.5	B			
001838 R ANDROMEDAE—						
	4108.6	[14.1	Ie	4119.6	[13.5	Br
	4117.5	14.4	Pt			
001862 S TUCANAE—						
	4069.9	9.2	Bl	4085.4	8.9	Sm
	4078.0	9.3	Bl	4088.0	8.7	Bl
	4079.3	8.9	Sm			
001909 S CETI—						
	4077.1	8.7	Ch	4116.6	13.0	Ie
	4087.0	9.1	Ch	4117.5	10.1	Mz
	4112.7	10.1	Sg	4117.5	10.1	Pt
002546 T PHOENICIS—						
	4078.0	[13.6	Bl	4081.3	[12.2	Sm
002833 W SCULPTORIS—						
	4078.0	13.0	Bl			
003179 Y CEPHEI—						
	4113.6	13.0	Br	4127.6	11.0	Br
004047 U CASSIOPEIAE—						
	4114.6	8.0	Ie	4120.7	8.2	Lv
	4117.5	8.4	Mz	4124.6	7.9	B
	4117.5	7.8	Pt	4125.5	8.5	Mz
004132 RW ANDROMEDAE—						
	4077.1	[11.0	Ch	4117.5	8.5	Pt
	4115.6	8.6	Ie	4121.5	8.9	Mz
004435 V ANDROMEDAE—						
	4088.6	[12.0	Mz	4121.7	11.5	Lv
	4119.6	11.4	Br			
004435 X SCULPTORIS—						
	4078.0	[13.6	Bl			
004533 RR ANDROMEDAE—						
	4114.5	10.1	B	4119.6	10.6	Br
004746a RV CASSIOPEIAE—						
	4114.6	10.8	Ie	4117.7	10.9	Pt
004746b — CASSIOPEIAE—						
	4114.6	10.6	Ie	4117.5	10.0	Pt
004958 W CASSIOPEIAE—						
	4117.5	11.3	Pt	4119.6	11.2	B
005475 U TUCANAE—						
	4060.3	8.5	Sm	4079.3	8.7	Sm
	4069.9	8.3	Bl	4084.3	8.9	Sm
	4078.0	8.3	Bl	4088.0	8.5	Bl
005840 RX ANDROMEDAE—						
	4106.6	10.5	Br	4127.6	11.8	Br
	4115.6	12.8	Br	4134.5	13.6	Pt
	4116.6	13.2	Br	4135.5	13.5	Pt
	4119.6	13.3	Br			
010102 Z CETI—						
	4107.6	8.9	B	4117.5	9.3	Pt
	4116.6	9.5	Br			
010630 U SCULPTORIS—						
	4069.9	10.2	Bl	4085.2	10.0	Bl
	4078.0	10.5	Bl			
010940 V ANDROMEDAE—						
	4097.1	[10.8	Mj	4115.6	11.1	Ie
	4115.6	13.8	Br	4127.6	[13.1	Br
011041 UZ ANDROMEDAE—						
	4115.6	10.5	Br	4119.5	11.1	B
	4115.6	11.1	Ie			
011208 S PISCIUM—						
	4115.6	10.7	Br	4116.6	11.2	Y
011272 S CASSIOPEIAE—						
	4115.7	12.5	Br	4134.5	12.6	Ie
011712 U PISCIUM—						
	4113.6	14.5	Br			
012350 RZ PERSEI—						
	4114.6	10.6	B	4115.7	10.8	Br
012502 R PISCIUM—						
	4077.6	[11.4	Ch	4116.6	[13.5	Y
	4115.7	13.4	Br	4121.7	11.4	Lv
013238 RU ANDROMEDAE—						
	4075.1	9.8	Ch	4119.5	11.8	B
	4090.1	10.0	Ch	4122.6	12.4	Ie
	4113.6	11.6	Br	4127.6	12.8	Br
	4117.5	11.5	Pt			
013338 Y ANDROMEDAE—						
	4075.1	9.8	Ch	4115.7	9.6	Br
	4090.1	9.6	Ch	4117.5	11.5	Pt
014958 X CASSIOPEIAE—						
	4117.5	9.9	Pt	4119.6	10.0	B
015354 U PERSEI—						
	4113.6	8.6	Sg	4115.6	8.3	Pt
015912 S ARIETIS—						
	4115.6	13.4	Pt			

VARIABLE STAR OBSERVATIONS RECEIVED DURING DECEMBER, 1924—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
021024 R ARIETIS—						
	4085.1	9.8	Mj	4116.6	7.8	Ly
	4085.9	9.5	Kk	4117.5	8.4	Mz
	4092.1	9.6	Mj	4118.6	7.9	Ms
	4093.0	9.5	Mj	4120.5	8.0	Ly
	4095.0	9.2	Mj	4121.7	8.5	Lv
	4100.6	8.6	Cy	4122.6	8.0	Wr
	4109.6	8.3	Gb	4122.6	8.1	Cy
	4110.6	8.3	Ie	4124.6	8.7	Jo
	4110.6	8.9	Wr	4125.5	8.2	Mz
	4114.6	9.0	Jo	4130.6	8.6	Hy
	4115.7	8.5	Br	4135.5	8.4	Ly
	4115.6	6.8	Pt			
021143a W ANDROMEDAE—						
	4085.9	9.4	Kk	4116.6	7.3	Br
	4115.6	6.8	Pt	4130.6	7.2	Ie
021258 T PERSEI—						
	4078.2	8.7	Ch	4115.6	8.4	Pt
021281 Z CEPHEI—						
	4115.6	13.5	Pt	4121.5	[11.0	Mz
	4116.6	[13.5	Ie	4127.7	[13.0	Br
	4116.7	14.0	Br			
021403 o CETI—						
	4062.0	8.7	Kk	4115.7	6.2	Cy
	4068.2	9.0	Ch	4116.6	5.6	Cy
	4075.9	8.5	Kk	4116.6	5.6	Ms
	4078.1	8.9	Ch	4117.6	5.8	Sg
	4080.1	8.8	Ch	4117.6	5.4	Ly
	4081.0	8.4	Kk	4118.5	5.5	Ms
	4084.0	8.3	Kk	4119.6	5.5	Ly
	4087.2	8.8	Ch	4119.8	5.4	Cy
	4088.0	8.4	Kk	4121.7	5.1	Cy
	4090.2	8.7	Ch	4122.6	5.0	Cy
	4092.2	8.6	Ch	4122.6	4.2	Hb
	4093.2	8.6	Ch	4124.6	4.6	Cy
	4094.1	8.5	Ch	4124.6	5.0	Jo
	4100.7	8.3	Cy	4129.5	4.4	Cy
	4104.6	7.5	Cy	4130.5	4.4	Cy
	4107.6	6.9	Cy	4130.6	4.5	Hy
	4108.5	7.3	Ms	4133.6	3.8	Sg
	4109.5	7.3	Ms	4134.5	4.0	Ho
	4109.6	7.5	Gb	4134.5	4.2	Ms
	4110.6	7.4	Ho	4134.5	4.5	Ly
	4112.7	6.0	Sg	4135.6	4.1	Pt
	4114.7	6.4	Cy	4140.5	4.2	Ly
	4115.6	6.1	Pt			
021558 S PERSEI—						
	4078.6	9.3	Ch	4115.6	8.9	Pt
	4107.6	9.6	B	4121.6	9.3	B
022000 R CETI—						
	4078.2	9.6	Ch	4117.6	[11.2	Mz
	4090.2	11.0	Ch			
022150 RR PERSEI—						
	4115.5	[12.5	Y	4127.7	[13.5	Br
022426 R FORNACIS—						
	4069.9	8.4	Bl	4080.9	8.5	Bl
	4078.0	9.2	Bl	4085.2	8.6	Bl
022813 U CETI—						
	4060.7	7.1	Kk	4078.2	7.2	Ch
	4061.0	7.1	Kk	4081.0	7.5	Kk
	4062.0	7.0	Kk	4082.2	7.5	Kk
	4069.0	7.2	Kk	4083.2	7.5	Kk
	4071.1	7.3	Kk	4084.0	7.5	Kk
	4072.0	7.3	Kk	4084.0	7.5	H
	4073.0	7.3	Kk	4085.0	7.5	Kk
	4074.0	7.2	Kk	4088.0	7.7	Kk
	4076.0	7.4	H	4092.2	7.3	Ch
	4076.0	7.4	Nk	4112.6	8.1	B
	4079.0	7.4	Kk	4115.6	7.9	Pt
022980 RR CEPHEI—						
	4115.6	12.7	Pt	4116.7	12.7	Ie
	4116.7	12.7	Br	4121.5	[10.4	Mz
023133 R TRIANGULI—						
	4060.0	7.4	Kk	4084.9	7.4	Kk
	4068.9	7.4	Kk	4088.0	7.4	Kk
	4073.9	7.4	Kk	4100.7	8.0	Cy
	4076.0	7.4	H	4115.6	6.5	Pt
	4079.0	7.3	Kk	4117.6	6.2	Mz
	4081.0	7.4	Kk	4121.7	6.0	Lv
	4082.9	7.4	Kk	4129.6	6.1	Ie
	4083.9	7.3	Kk	4130.6	5.8	Hy
	4084.0	7.4	H	4134.6	6.7	Hu
024356 W PERSEI—						
	4060.0	10.0	Nk	4100.7	9.4	Cy
	4060.1	10.0	Nk	4106.6	9.8	Cy
	4068.1	10.0	Nk	4107.5	9.4	B
	4069.1	10.1	Mj	4108.6	9.8	Ms
	4069.4	9.8	Nk	4108.6	9.8	Cy
	4073.9	9.5	Nk	4114.6	9.8	Cy
	4076.0	9.5	Nk	4115.6	9.9	Pt
	4076.1	9.9	Mj	4117.5	10.2	Mz
	4078.9	9.8	Nk	4118.5	9.5	Ms
	4081.0	9.9	Nk	4118.7	9.9	Cy
	4084.0	10.1	Nk	4121.6	9.3	B
	4092.0	10.2	Mj	4124.6	9.9	Cy
	4093.0	10.2	Mj	4130.7	9.9	Hy
	4095.0	10.2	Mj	4130.7	9.9	Cy
	4098.0	10.2	Mj	4134.6	9.2	Hu
025050 R FORNACIS—						
	4060.3	6.6	Sm	4079.3	6.7	Sm
	4070.0	5.8	Bl	4084.3	6.8	Sm
	4078.0	6.1	Bl	4085.2	6.6	Bl
032043 Y PERSEI—						
	4061.3	9.2	Nk	4081.0	9.7	Nk
	4068.1	9.0	Nk	4107.6	9.8	B
	4069.4	9.1	Nk	4115.6	9.9	Pt
	4076.1	9.6	Nk	4121.6	10.0	B
	4079.0	9.7	Nk	4134.6	10.3	Br
032335 R PERSEI—						
	4114.6	10.7	B	4116.7	10.5	Br
	4115.5	10.6	Ie	4134.6	10.6	Hu
	4115.6	10.5	Pt			
042209 R TAURI—						
	4084.2	[10.6	Ch	4121.6	12.5	B
	4109.6	[13.0	Y	4131.6	12.8	B
	4116.6	[13.0	Ie			

VARIABLE STAR OBSERVATIONS RECEIVED DURING DECEMBER, 1924—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
042215 W TAURI—						
	4095.1	10.3	Mj	4117.6	9.8	Sg
	4098.1	10.3	Mj	4120.6	8.7	Jo
	4106.6	10.1	Cy	4121.5	9.5	Mh
	4112 6	9.5	B	4122.6	9.7	Cy
	4114.7	9.8	Cy	4128.6	9.4	B
	4115.6	9.5	Pt	4133.5	9.0	Mh
	4117.5	11.1	Mz	4133.6	10.1	Sg
	4117.6	10.1	Ks	4134.6	10.0	Hu
042309 S TAURI—						
	4107.6	[13.4	B	4121.6	[13.0	B
	4109.6	[13.0	Y	4136.6	[12.0	B
	4116.6	[13.0	Ie			
043065 T CAMELOPARDALIS—						
	4115.6	12.0	Pt	4119.7	12.9	Br
043208 RZ TAURI—						
	4112.6	13.0	B	4116.7	13.0	Br
043263 R RETICULI—						
	4078.1	11.1	Bl	4085.2	10.5	Bl
043274 X CAMELOPARDALIS—						
	4115.6	8.5	Pt	4116.7	9.0	Ie
	4115.6	8.3	B	4121.6	8.5	Mz
	4116.7	8.6	Br	4132.6	9.3	B
043562 R DORADUS—						
	4060.3	6.1	Sm	4084.3	6.2	Sm
	4078.1	6.2	Bl	4085.2	6.2	Bl
	4079.4	6.1	Sm			
043738 R CAELI—						
	4078.1	12.8	Bl			
044349 R PICTORIS—						
	4078.1	7.2	Bl	4088.0	7.4	Bl
044617 V TAURI—						
	4115.6	11.2	B	4117.5	10.6	Pt
	4116.6	11.3	Ie	4132.6	11.8	B
	4116.7	11.3	Br			
045307 R ORIONIS—						
	4116.7	10.5	Br	4124.6	10.9	Ie
	4122.7	10.6	B	4128.6	10.6	B
045514 R LEPORIS—						
	4067.2	8.6	Kk	4115.7	8.0	Br
	4078.2	8.5	Ch	4118.6	7.1	Pt
	4083.2	8.5	Kk	4124.7	7.0	Jo
	4088 3	8.6	Kk	4125.6	7.7	B
	4092.2	8.3	Ch			
050003 V ORIONIS—						
	4118.6	9.8	Pt	4122.6	9.6	B
	4119.8	9.8	Br	4136.6	9.0	B
	4122.6	9.4	Ie			
050022 T LEPORIS—						
	4078.1	11.0	Bl	4118.6	9.6	Pt
	4088 0	10.9	Bl	4128.6	8.6	B
050848 S PICTORIS—						
	4078.1	13.1	Bl	4084.4	[12.2	Sm
050953 R AURIGAE—						
	4113.7	13.0	Br	4118.6	13.5	Pt
	4116.5	13.3	Ie	4125.6	12.5	B
051247 T PICTORIS—						
	4078.1	9.1	Bl	4088.0	10.0	Bl
	4079.4	8.7	Sm			
051533 T COLUMBAE—						
	4078.1	8.4	Bl	4084.3	8.5	Sm
	4079.4	8.7	Sm	4088.0	8.7	Bl
052034 S AURIGAE—						
	4084.0	9.3	Ch	4118.6	8.3	Pt
	4112.7	9.0	Sg	4128.6	8.9	B
052036 W AURIGAE—						
	4108.6	[12.6	Ie	4135.6	[12.6	B
	4118.6	14.6	Pt			
052404 S ORIONIS—						
	4118 6	8.0	Pt	4135.5	8.0	Pt
	4119.8	8.1	Br	4136.6	7.8	B
	4122.6	8.1	B			
053005a T ORIONIS—						
	4109.6	10.4	Pt	4120.6	10.5	Pt
	4111 6	10.4	Pt	4122.6	11.8	B
	4115.6	10.4	Pt	4135.5	9.9	Pt
	4118.6	10 3	Pt	4136.6	10.8	B
053068 S CAMELOPARDALIS—						
	4118.6	8.6	Pt			
053326 RR TAURI—						
	4121.6	13.2	B	4135.6	12.4	B
053337 RU AURIGAE—						
	4116.7	[13.4	Sg	4119.7	[13.4	Br
053531 U AURIGAE—						
	4084.2	10.2	Ch	4134.5	11.5	Ie
	4118.6	11.0	Pt	4136.6	11.6	B
	4122.6	11.1	B			
054319 S TAURI—						
	4109.6	13.0	Pt	4118.6	12.7	Pt
	4111.5	13.3	Pt	4119.7	12.5	Br
	4113.7	12.3	Br	4119.7	12.8	B
	4115.6	12.4	Ie	4120.8	13.3	Pt
	4155.6	13.3	Pt	4121.7	12 8	B
	4115.7	12.6	B	4121.8	13.5	Pt
	4115.7	12.5	Br	4122.8	12.5	Ie
	4116.7	12.6	Br	4125.6	12.7	B
054331 S COLUMBAE—						
	4079.4	[12.2	Sm			
054615a Z TAURI—						
	4116.6	11.1	Ie	4119.7	11.0	Br
	4117.6	11.3	Ks			
054617c RU TAURI—						
	4116.6	13.5	Ie	4119.7	13.0	Br
054629 R COLUMBAE—						
	4078.1	12.8	Bl			
054920a U ORIONIS—						
	4061.1	6.4	Kk	4085.0	7.4	Kk
	4069.0	6.7	Kk	4088.1	7.4	Kk
	4074.0	6 9	Kk	4107.6	8.1	Cy
	4076.0	7.0	Kk	4114.7	8.3	Cy
	4079.1	6.7	Nk	4115.6	9.2	Br
	4081.0	7.1	Kk	4118.6	7.1	Pt
	4081.1	6.9	Nk	4120.6	8.1	Jo
	4083.2	7.2	Kk	4122 6	8.4	B
	4084.0	7.4	Kk	4136.6	8.5	B

VARIABLE STAR OBSERVATIONS RECEIVED DURING DECEMBER, 1924—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
054920b UW ORIONIS—						
	4107.6	10.5	Cy	4119.8	10.4	Cy
	4114.7	10.7	Cy	4122.7	10.5	Cy
	4115.7	10.7	Cy	4124.6	10.5	Cy
	4118.7	10.5	Cy			
054974 V CAMELOPARDALIS—						
	4118.6	12.9	Pt	4122.6	13.1	Ie
	4119.7	13.3	Br			
055353 Z AURIGAE—						
	4115.7	10.0	B	4124.6	9.7	B
	4118.6	9.6	Pt	4135.6	9.4	B
	4122.7	9.8	B			
055686 R OCTANTIS—						
	4078.1	10.9	Bl	4085.2	11.2	Bl
	4084.4	10.9	Sm			
060450 X AURIGAE—						
	4116.5	8.7	Ie	4125.6	8.7	B
	4118.6	8.5	Pt			
060547 SS AURIGAE—						
	4069.4	[11.2	Ch	4116.7	[14.5	Sg
	4069.4	[14.5	Nk	4116.7	[14.5	Br
	4070.4	[11.2	Ch	4117.6	[13.5	B
	4072.4	[10.8	Ch	4117.5	[12.6	Pt
	4075.4	[10.8	Ch	4118.5	[13.5	Cd
	4076.4	[10.8	Ch	4119.8	[14.5	Br
	4078.2	[10.8	Ch	4119.8	[13.0	Cy
	4079.1	14.9	Nk	4120.5	[12.6	Pt
	4084.2	[11.6	Ch	4121.8	[12.6	Pt
	4085.2	[12.4	Ch	4122.6	[12.5	B
	4086.2	[11.6	Ch	4125.6	[13.0	B
	4087.2	[11.6	Ch	4124.5	[13.0	Ie
	4088.2	[11.6	Ch	4129.6	10.7	Ie
	4089.2	[11.6	Ch	4130.5	10.7	Ie
	4090.2	[11.2	Ch	4133.5	10.4	Ks
	4091.2	[11.6	Ch	4133.6	11.0	B
	4092.2	[11.6	Ch	4133.8	10.6	Cy
	4093.2	[11.2	Ch	4134.5	10.9	Ie
	4094.2	[11.2	Ch	4134.6	11.1	Pt
	4110.5	[12.6	Pt	4134.6	11.1	B
	4111.5	[12.6	Pt	4135.6	11.1	B
	4112.7	[12.4	Sg	4136.6	10.9	B
	4115.7	[13.9	Br			
	4115.7	[12.4	Cy			
060647 V AURIGAE—						
	4117.6	9.9	B	4133.6	9.8	B
061702 V MONOCEROTIS—						
	4121.8	11.3	Pt			
063159 U LYNCIS—						
	4125.6	13.7	B			
063308 R MONOCEROTIS—						
	4121.8	10.7	Pt			
063558 S LYNCIS—						
	4113.7	12.0	Br	4125.6	10.9	Pt
	4121.8	10.7	B			
064030 X GEMINORUM—						
	4119.8	13.3	Br	4124.6	13.2	Ie
064707 W MONOCEROTIS—						
	4121.8	9.7	Pt			
065111 Y MONOCEROTIS—						
	4119.8	13.0	Br	4121.8	12.5	Pt
065208 X MONOCEROTIS—						
	4088.3	7.6	Kk			
065355 R LYNCIS—						
	4119.7	11.6	B	4134.5	12.3	Ie
	4121.8	12.1	Pt			
070122a R GEMINORUM—						
	4084.0	7.2	Kk	4122.6	6.8	Hb
	4085.2	7.1	Kk	4124.7	6.6	Ie
	4088.3	7.2	Kk	4139.7	7.0	Al
	4121.8	6.3	Pt			
070122b Z GEMINORUM—						
	4121.8	12.4	Pt	4124.7	12.3	Ie
070122c TW GEMINORUM—						
	4121.8	7.8	Pt			
070772 R VOLANTIS—						
	4060.4	11.8	Sm	4084.3	11.5	Sm
	4079.3	11.8	Sm			
071713 V GEMINORUM—						
	4121.8	13.4	Pt			
072708 S CANIS MINORIS—						
	4112.7	10.4	Jo	4130.6	9.7	Ie
	4114.7	11.3	Cy	4139.7	9.7	Al
	4121.8	10.4	Pt			
072811 T CANIS MINORIS—						
	4121.8	12.1	Pt			
073173 S VOLANTIS—						
	4078.1	10.9	Bl	4085.2	10.9	Bl
073508 U CANIS MINORIS—						
	4121.8	9.1	Pt			
073723 S GEMINORUM—						
	4124.6	[13.6	Ie			
074241 W PUPPIS—						
	4078.1	12.8	Bl	4085.4	11.7	Sm
	4085.2	11.7	Bl			
074922 U GEMINORUM—						
	4068.4	[12.3	Ch	4104.8	[12.4	Cy
	4069.4	[12.3	Ch	4107.7	[12.4	Cy
	4070.4	[10.9	Ch	4109.6	[12.4	Pt
	4072.4	[10.9	Ch	4111.6	[12.4	Pt
	4075.4	[10.9	Ch	4114.7	[12.4	Cy
	4076.4	[10.9	Ch	4115.7	[13.3	Cy
	4077.3	[10.1	Ch	4117.7	[13.3	Ie
	4078.5	[9.3	Ch	4116.6	[12.6	Ie
	4080.3	[10.2	Ch	4116.9	[12.4	Cy
	4081.4	[10.9	Ch	4118.6	[13.5	Cd
	4082.4	[12.4	Ch	4118.7	[12.4	Cy
	4085.2	[10.9	Ch	4119.8	[13.3	Cy
	4086.3	[12.3	Ch	4120.8	[13.3	Pt
	4087.2	[10.9	Ch	4121.7	[12.4	Cy
	4088.4	[12.4	Ch	4121.8	[13.3	Pt
	4090.4	[12.4	Ch	4122.7	[12.6	Ie
	4091.4	[12.4	Ch	4122.7	[13.3	Cy
	4092.2	[10.9	Ch	4124.6	[12.6	Ie
	4093.4	[12.4	Ch	4124.7	[12.4	Cy
	4100.7	[10.9	Cy	4135.6	[12.7	B
075625 U PUPPIS—						
	4091.4	[10.8	Ch			
081112 R CANCRI—						
	4116.9	11.0	Cy	4121.8	10.6	Pt

VARIABLE STAR OBSERVATIONS RECEIVED DURING DECEMBER, 1924—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
081617 V CANCRI—						
	4090.4	11.2	Ch	4121.8	9.0	Pt
	4116.9	9.2	Cy			
082405 RT HYDRAE—						
	4121.8	7.9	Pt			
082476 R CHAMAELEONTIS—						
	4060.3	11.5	Sm	4084.3	[12.4	Sm
	4078.1	12.3	Bl			
083019 U CANCRI—						
	4016.9	[11.9	Cy			
083350 X URSAE MAJORIS—						
	4121.9	13.2	Pt			
084803 S HYDRAE—						
	4121.9	9.5	Pt			
085008 T HYDRAE—						
	4083.4	8.0	Ch	4121.9	9.7	Pt
085120 T CANCRI—						
	4061.4	9.3	Nk	4119.8	9.7	Cy
	4091.4	9.3	Ch	4121.9	8.1	Pt
090024 X PYXIDIS—						
	4121.9	12.3	Pt			
090151 V URSAE MAJORIS—						
	4061.4	10.2	Nk			
090425 W CANCRI—						
	4119.8	13.2	Cy			
091868 RW CARINAE—						
	4078.1	[12.8	Bl			
092551 Y VELORUM—						
	4078.1	[12.9	Bl			
092962 R CARINAE—						
	4078.1	5.2	Bl	4085.2	4.3	Bl
093014 X HYDRAE—						
	4088.4	[11.0	Ch	4121.9	12.9	Pt
093178 Y DRACONIS—						
	4104.7	[12.9	Cy	4122.7	[13.4	Ie
	4115.8	[12.0	Cy			
093934 R LEONIS MINORIS—						
	4119.8	12.2	Cy	4121.9	11.9	Pt
094211 R LEONIS—						
	4061.4	9.4	Nk	4088.3	9.8	Kk
	4066.4	9.8	Ch	4116.9	10.4	Cy
	4083.4	10.3	Ch	4121.9	9.8	Pt
094622 Y HYDRAE—						
	4121.9	6.5	Pt			
094953 Z VELORUM—						
	4078.1	11.7	Bl	4085.2	11.6	Bl
095421 V LEONIS—						
	4091.4	10.7	Ch	4121.9	8.5	Pt
	4116.9	8.9	Cy			
095563 RV CARINAE—						
	4085.2	[13.1	Bl			
100661 S CARINAE—						
	4085.2	9.6	Bl	4088.0	9.4	Bl
101058 Z CARINAE—						
	4078.1	10.7	Bl	4085.2	11.3	Bl
101153 W VELORUM—						
	4085.2	8.5	Bl			
103212 U HYDRAE—						
	4082.2	5.8	Kk	4085.2	5.9	Kk
	4083.3	5.8	Kk	4088.2	6.2	Kk
	4084.2	5.9	Kk			
103769 R URSAE MAJORIS—						
	4088.4	11.4	Ch	4117.5	10.0	Mh
	4093.4	11.2	Ch	4118.7	10.2	Ms
	4112.6	10.8	Sg	4121.9	9.6	Pt
	4115.6	10.7	Ie	4134.6	8.2	Ly
	4115.8	10.4	Cy	4140.6	7.0	Ly
104620 V HYDRAE—						
	4085.2	10.0	Bl	4121.9	10.6	Pt
	4088.4	11.4	Ch			
104628 RS HYDRAE—						
	4085.2	12.8	Bl			
104814 W LEONIS—						
	4116.9	[12.7	Cv			
110506 S LEONIS—						
	4119.9	13.0	Cy	4121.9	13.0	Pt
111561 RY CARINAE—						
	4085.2	12.3	Bl			
111665 RS CENTAURI—						
	4068.9	8.4	Bl	4085.2	9.9	Bl
114441 X CENTAURI—						
	4085.3	8.6	Bl			
115058 W CENTAURI—						
	4068.9	8.6	Bl	4085.2	9.2	Bl
120012 SU VIRGINIS—						
	4121.9	11.5	Pt			
122532 T CANUM VENATICORUM—						
	4121.9	9.3	Pt			
122854 U CENTAURI—						
	4068.9	8.6	Bl	4085.2	7.3	Bl
123160 T URSAE MAJORIS—						
	4060.9	8.4	Kk	4088.	8.3	Kl
	4080.	8.3	Kl	4088.3	8.2	Kk
	4081.	8.3	Kl	4091.	8.2	Kl
	4082.	8.3	Kl	4098.	8.3	Kl
	4083.	8.2	Kl	4100.	8.4	Kl
	4083.3	8.6	Kk	4121.9	9.2	Pt
	4084.	8.2	Kl	4122.6	8.9	Ie
	4085.2	8.5	Kk			
123307 R VIRGINIS—						
	4121.9	8.2	Pt			
123459 RS URSAE MAJORIS—						
	4119.9	[13.2	Cy	4121.9	14.3	Pt
123961 S URSAE MAJORIS—						
	4068.0	8.5	Ik	4084.	8.8	Ik
	4076.0	8.6	Kl	4088.	9.3	Kl
	4079.0	8.8	Ik	4091.	9.3	Kl
	4080.	8.8	Kl	4098.	9.5	Kl
	4081.	9.2	Kl	4100.	10.1	Kl
	4082.	9.3	Kl	4115.8	10.0	Cy
	4083.	9.1	Kl	4121.9	13.3	Pt
	4084.	8.9	Kl			
124204 RU VIRGINIS—						
	4121.9	13.3	Pt			
124606 U VIRGINIS—						
	4121.9	8.7	Pt			

VARIABLE STAR OBSERVATIONS RECEIVED DURING DECEMBER, 1924—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
131283 U OCTANTIS—						
	4060.3	9.0	Sm	4078.9	10 4	Bl
	4068 9	9.2	Bl	4079.4	10.3	Sm
	4075.9	10.0	Bl	4084.3	10.5	Sm
132422 R HYDRAE—						
	4121.9	8.9	Pt			
132706 S VIRGINIS—						
	4121.9	12.4	Pt			
133155 RV CENTAURI—						
	4068.9	7.4	Bl	4089.9	7.2	Bl
	4075.9	7.5	Bl			
133273 T URSAE MINORIS—						
	4113.7	13.7	Br			
133633 T CENTAURI—						
	4069.9	6.5	Bl			
134440 R CANUM VENATICORUM—						
	3121.9	8.1	Pt			
134536 RX CENTAURI—						
	4069.9	9.3	Bl			
134677 T APODIS—						
	4075.9	12.1	Bl	4085 4	11.7	Sm
	4079.4	12.3	Sm	4087.9	10.9	Bl
135908 RR VIRGINIS—						
	4121.9	13.2	Pt			
140512 Z VIRGINIS—						
	4121.9	10.5	Pt			
140959 R CENTAURI—						
	4060.3	5.9	Sm	4081.3	6.1	Sm
	4068.9	5.9	Bl	4087.9	6.0	Bl
	4075.9	5.8	Bl			
141567 U URSAE MINORIS—						
	4079.0	10.1	Ch	4121.9	9.1	Pt
141954 S BOOTIS—						
	4121.9	9.2	Pt	4124.9	9.8	Cy
142539 V BOOTIS—						
	4121.9	9.0	Pt	4124.9	8.7	Cy
143227 R BOOTIS—						
	4121.9	9.4	Pt			
144254 Y LUPI—						
	4076.0	[13.0	Bl			
145971 S APODIS—						
	4060.3	9.9	Sm	4084 4	10.0	Sm
	4068.9	9.9	Bl	4087.9	9.9	Bl
	4075.9	9.8	Bl	4088.3	10.0	Sm
	4079.3	10.0	Sm			
151731 S CORONAE BOREALIS—						
	4078.9	10.0	Nk	4087.0	8.7	Ch
	4079.0	10.2	Ch	4121.9	6 8	Pt
151822 RS LIBRAE—						
	4060.2	7.2	Sm	4077.9	7.2	Bl
	4068 9	7.1	Bl	4087.9	7.7	Bl
152849 R NORMAE—						
	4060.3	11.9	Sm	4077.9	12.9	Bl
	4069.9	12.5	Bl			
153215 W LIBRAE—						
	4069.9	10.5	Bl			
153378 S URSAE MINORIS—						
	4104.8	11.2	Cy	4121.9	9.8	Pt
	4112.6	11.2	Sg	4130.7	10.4	Hy
154428 R CORONAE BOREALIS—						
	4019.9	5.9	Kk	4080.8	7.6	Kk
	4020.9	5.9	Kk	4081.0	8.0	Ch
	4023.9	6.0	Kk	4082.8	7.5	Kk
	4025.9	5.9	Kk	4081.0	8.0	Ch
	4026.9	6.0	Kk	4083.8	7.5	Kk
	4028.0	6.0	Kk	4084.9	7.4	Kk
	4028.9	6.0	Kk	4085.9	7.4	Kk
	4030.9	6.0	Kk	4087.0	7.0	Ch
	4034.9	6.0	Kk	4087.8	7.1	Kk
	4035.9	6.0	Kk	4088.8	7.1	Kk
	4038.9	6.1	Kk	4090 0	6.9	Ch
	4041.9	6.1	Kk	4092.0	6.8	Ch
	4045.9	6.1	Kk	4108.5	6.5	Ms
	4047.9	6.3	Kk	4108.5	6.2	Ie
	4050.9	6.2	Kk	4109.5	6.3	Ie
	4053 9	6.2	Kk	4109.5	6.2	Pt
	4054.9	6.3	Kk	4110.6	6.0	Sg
	4058.9	6.9	Kk	4115.4	6.3	Ie
	4060 9	7.0	Kk	4115.5	6.2	Pt
	4061.9	7.0	Kk	4116.5	6.2	Ly
	4068.9	7.3	Kk	4117.5	6.2	Pt
	4072.0	8.8	Ch	4118.5	6.2	Pt
	4075.1	8.4	Ch	4119.9	6.3	Cy
	4078.8	7.5	Kk	4121.9	6.3	Pt
	4076.0	8.5	Ch	4124.9	6.3	Cy
	4078 8	7.5	Kk	4126.9	6.2	Ms
	4079.0	8.2	Ch			
154536 X CORONAE BOREALIS—						
	4108.5	10.8	Ie	4121.9	10.3	Pt
154615 R SERPENTIS—						
	4121.9	10.4	Pt			
154639 V CORONAE BOREALIS—						
	4121.9	7.2	Pt			
155229 Z CORONAE BOREALIS—						
	4108.5	[12.5	Ie			
155823 RZ SCORPII—						
	4060.3	11.2	Sm	4081.3	8.6	Sm
160021 Z SCORPII—						
	4060.3	10.0	Sm	4080.9	10.4	Bl
	4069.9	10.2	Bl	4087.9	10.1	Bl
160118 R HERCULIS—						
	4076.0	[10.7	Ch	4121.9	8.9	Pt
160210 U SERPENTIS—						
	4078.9	11.7	Nk			
160325 SX HERCULIS—						
	4109.6	9.2	Pt	4118.5	8.1	Pt
	4115.5	8.4	Pt	4121.9	8.0	Pt
	4117.5	8.1	Pt			
160625 RU HERCULIS—						
	4121.9	12.3	Pt			
161122a R SCORPII—						
	4081.3	[11.0	Sm	4087.9	11.5	Bl
161122b S SCORPII—						
	4060.3	[11.9	Sm	4081.3	[11.0	Sm
	4078.9	[11.5	Bl			
161138 W CORONAE BOREALIS—						
	4108.5	11.3	Ie	4109.5	11.2	Pt
161607 W OPHIUCHI—						
	4080.0	[11.4	Ch			

VARIABLE STAR OBSERVATIONS RECEIVED DURING DECEMBER, 1924—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
162119 U HERCULIS—						
	4109.5	12.5	Pt			
162816 S OPHIUCHI—						
	4068.9	10.3	Bl			
163137 W HERCULIS—						
	4075.1	9.6	Ch	4109.5	12.4	Pt
	4079.1	9.8	Ch			
163266 R DRACONIS—						
	4076.0	9.8	Ch	4109.5	7.5	Pt
	4090.1	8.8	Ch			
164715 S HERCULIS—						
	4068.0	9.8	Ik	4109.5	11.6	Pt
	4083.0	10.4	Ch			
164844 RS SCORPII—						
	4060.3	10.6	Sm	4079.3	11.0	Sm
	4068.9	10.9	Bl	4084.3	11.0	Sm
	4076.0	10.9	Bl	4087.9	11.1	Bl
165030 RR SCORPII—						
	4068.9	11.7	Bl	4087.9	12.0	Bl
	4076.0	11.5	Bl			
165631 RV HERCULIS—						
	4060.0	13.1	Nk	4109.5	14.6	Pt
	4075.9	14.5	Nk	4118.5	[12.2	Ie
	4079.0	14.4	Nk	4120.6	[12.2	Sg
165636 RT SCORPII—						
	4068.9	9.4	Bl	4087.9	10.6	Bl
	4076.0	10.4	Bl			
170215 R OPHIUCHI—						
	4080.0	11.5	Ch			
170833 RW SCORPII—						
	4076.0	[12.6	Bl			
171401 Z OPHIUCHI—						
	4109.5	8.6	Pt			
171723 RS HERCULIS—						
	4060.0	8.3	Nk	4079.0	8.4	Nk
	4073.9	8.1	Nk	4081.0	8.4	Nk
	4075.9	8.3	Nk	4109.5	8.7	Pt
172486 S OCTANTIS—						
	4076.0	[13.3	Bl			
173543 RU SCORPII—						
	4068.9	8.6	Bl	4087.9	8.8	Bl
	4076.0	8.8	Bl			
174135 SV SCORPII—						
	4076.0	[12.5	Bl			
174162 W PAVONIS—						
	4076.0	[13.0	Bl			
174406 RS OPHIUCHI—						
	4109.5	11.1	Pt			
174551 U ARAE—						
	4060.3	8.3	Sm	4084.3	8.6	Sm
	4079.3	8.4	Sm			
175519 RY HERCULIS—						
	4108.5	13.5	Ie	4109.5	12.3	Pt
175654 V DRACONIS—						
	4109.5	10.8	Pt	4116.5	10.5	Ie
180363 R PAVONIS—						
	4060.3	8.2	Sm	4084.3	8.3	Sm
	4079.3	8.3	Sm			
180531 T HERCULIS—						
	4061.9	9.6	Kk	4124.5	12.7	Ie
	4109.5	13.0	Pt			
180565 W DRACONIS—						
	4109.5	12.5	Pt	4133.5	[13.0	Bi
	4115.6	13.5	Ie			
180666 X DRACONIS—						
	4109.5	11.0	Pt	4115.6	12.0	Ie
180911 NOVA OPHIUCHI #4—						
	4109.5	13.5	Pt			
181103 RY OPHIUCHI—						
	4109.5	9.8	Pt			
181136 W LYRAE—						
	4060.0	9.2	Kk	4109.5	10.1	Pt
	4069.0	9.0	Mj	4112.5	10.4	B
	4076.0	9.5	Nk	4112.6	10.0	Sg
	4079.0	9.2	Nk	4114.6	[10.1	Mz
	4081.0	9.5	Nk	4135.5	[10.5	Mz
182133 RV SAGITTARII—						
	4076.0	13.0	Bl	4087.9	12.5	Bl
182306 T SERPENTIS—						
	4111.5	10.7	Pt	4115.5	10.3	Mz
183225 RZ HERCULIS—						
	4089.5	9.8	Y			
183308 X OPHIUCHI—						
	4111.5	7.0	Pt	4116.5	7.7	Ly
184134 RY LYRAE—						
	4111.5	14.3	Pt			
184205 R SCUTI—						
	4060.0	6.2	Kk	4107.5	5.4	Ms
	4060.9	6.1	Kk	4108.5	5.6	Ms
	4062.0	6.0	Kk	4109.5	5.7	Ms
	4068.9	5.5	Kk	4109.5	5.3	Pt
	4070.9	5.8	Kk	4109.5	5.5	Mh
	4071.9	5.7	Kk	4110.5	5.3	Pt
	4072.9	5.8	Kk	4111.5	5.3	Pt
	4073.5	5.9	Kk	4112.6	5.8	Sg
	4075.8	5.9	Kk	4115.5	5.3	Pt
	4078.9	5.9	Kk	4115.5	5.5	Ie
	4081.0	5.9	Kk	4116.5	5.4	Cy
	4082.9	5.8	Kk	4116.5	5.3	Ly
	4083 8	5.7	Kk	4117.5	5.4	Pt
	4084.0	5.7	H	4117.5	6.0	Mh
	4084.9	5.9	Kk	4118.5	5.2	Pt
	4085.9	5.7	Kk	4118.5	5.5	Ms
	4087.8	5.7	Kk	4121.5	5.2	Pt
	4088.8	5.7	Kk	4122.5	5.1	Pt
	4104.5	5 3	Cy	4122.5	5.1	Pt
184300 NOVA AQUILAE #3—						
	4060.0	10.4	Nk	4114.5	10.4	B
	4073.9	10.3	Nk	4115.5	10.3	Pt
	4076.0	10.2	Nk	4115.5	10.3	Mz
	4079 0	10.2	Nk	4122.5	10.1	Pt
	4079.1	10.4	Ch	4129.5	10.3	Ie
	4109.5	10.3	Pt	4134.5	10.2	Pt
	4112.6	10.2	Sg			
185032 RX LYRAE—						
	4080.2	[12.5	Ch	4115.5	[12.5	Mz

VARIABLE STAR OBSERVATIONS RECEIVED DURING DECEMBER, 1924—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
185437a S CORONAE AUSTRALIS—						
	4069.0	11.9	Bl	4075.9	11.7	Bl
	4069.9	11.9	Bl	4087.9	12.1	Bl
185512a ST SAGITTARII—						
	4079.1	[11.2	Ch			
185537a R CORONAE AUSTRALIS—						
	4069.9	12.2	Bl	4075.9	12.1	Bl
185537b T CORONAE AUSTRALIS—						
	4076.0	[12.8	Bl			
185634 Z LYRAE—						
	4107.5	13.2	B	4117.5	13.1	B
	4114.5	13.1	B	4122.5	13.1	B
185737 RT LYRAE—						
	4080.2	[12.0	Ch			
190108 R AQUILAE—						
	4080.1	11.0	Ch	4115.5	8.7	Mz
	4111.5	8.3	Pt	4115.6	8.5	B
190925a V LYRAE—						
	4116.6	12.5	Y	4134.5	[12.4	Ie
190818 RX SAGITTARII—						
	4079.1	11.2	Ch	4088.0	10.6	Ch
190819a RW SAGITTARII—						
	4079.1	11.0	Ch	4088.0	11.3	Ch
190907 TY AQUILAE—						
	4111.5	10.2	Pt			
190925 S LYRAE—						
	4080.2	11.8	Ch	4125.5	13.0	B
	4111.5	13.0	Pt			
190926 X LYRAE—						
	4111.5	8.8	Pt			
190933a RS LYRAE—						
	4080.2	[11.1	Ch			
190941 RU LYRAE—						
	4111.5	10.8	Pt	4129.5	11.0	Ie
190967a U DRACONIS—						
	4076.1	10.6	Ch	4115.6	12.6	Ie
	4111.5	12.1	Pt			
191007 W AQUILAE—						
	4079.7	[11.0	Ch	4111.5	12.6	Pt
191017 T SAGITTARII—						
	4079.1	11.3	Ch	4111.5	11.6	Pt
191019 R LYRAE—						
	4068.0	8.0	Ik	4079.1	8.5	Ch
	4073.0	8.5	Ik	4084.0	8.7	Ik
	4076.0	8.5	Ik	4088.0	8.7	Ch
	4079.0	8.6	Ik	4115.5	10.1	Pt
191033 RY SAGITTARII—						
	4060.4	7.6	Sm	4084.3	7.7	Sm
	4069.0	7.9	Bl	4087.9	7.6	Bl
	4069.9	7.1	Bl	4088.0	7.8	Ch
	4076.0	7.9	Bl	4088.3	7.5	Sm
	4079.0	7.8	Ch	4109.5	7.5	Pt
	4079.3	7.7	Sm	4117.5	7.5	Pt
191124 TY SAGITTARII—						
	4076.0	11.4	Bl	4087.9	10.2	Bl
191319 S SAGITTARII—						
	4069.0	9.9	Bl	4087.9	9.7	Bl
	4076.0	9.8	Bl	4111.5	11.4	Pt
191331 SW SAGITTARII—						
	4076.0	[12.9	Bl			
191350 TZ CYGNI—						
	4111.5	11.4	Pt	4116.6	11.2	Y
	4115.6	11.4	Mz			
191637 U LYRAE—						
	4111.5	10.8	Pt			
192745 AF CYGNI—						
	4017.9	7.1	Kk	4060.0	6.8	Kk
	4023.9	7.0	Kk	4068.9	7.2	Kk
	4025.9	7.0	Kk	4073.9	6.9	Kk
	4028.0	7.1	Kk	4081.0	7.2	Kk
	4030.1	6.9	Kk	4082.9	7.2	Kk
	4031.0	7.0	Kk	4083.9	7.3	Kk
	4035.0	7.1	Kk	4084.9	7.5	Kk
	4038.9	7.2	Kk	4085.9	7.5	Kk
	4045.9	6.9	Kk	4087.9	7.5	Kk
	4050.9	6.7	Kk	4088.8	7.4	Kk
	4054.0	6.8	Kk			
192928 TY CYGNI—						
	4079.2	10.0	Ch	4111.5	10.6	Pt
	4091.1	10.0	Ch			
193311 RT AQUILAE—						
	4110.5	[13.4	Ch	4114.6	13.3	B
	4111.5	14.2	Pt			
193449 R CYGNI—						
	4069.0	9.1	Mj	4115.6	9.7	Bi
	4072.2	8.5	Ch	4116.5	9.7	Ly
	4076.1	9.2	Mj	4116.5	9.6	Ms
	4078.2	8.9	Ch	4118.5	10.0	Ms
	4081.0	9.3	Nk	4119.5	9.9	Ly
	4081.0	9.3	Mj	4120.6	9.8	Lv
	4085.0	9.3	Mj	4122.5	9.9	Ly
	4089.2	9.3	Ch	4122.5	10.0	Cy
	4095.0	9.4	Mj	4122.6	9.8	Bl
	4104.5	9.6	Cy	4124.6	10.5	Jo
	4109.6	9.2	Gb	4124.6	9.7	Ie
	4110.6	9.5	Sg	4125.5	10.1	Mz
	4111.5	8.8	Pt	4128.5	9.5	B
	4112.5	9.4	B	4128.7	9.7	Sg
	4114.6	9.9	Mz	4133.5	9.9	Bi
	4114.6	10.0	Jo	4135.5	10.2	Mz
193509 RV AQUILAE—						
	4111.5	12.4	Pt	4114.5	12.8	Ie
193972 T PAVONIS—						
	4060.4	8.8	Sm	4079.3	9.2	Sm
	4069.0	8.9	Bl	4084.3	9.5	Sm
	4076.0	9.2	Bl	4087.9	9.7	Bl
194048 RT CYGNI—						
	4069.0	8.0	Mj	4111.5	10.1	Pt
	4072.2	8.1	Ch	4112.5	9.8	B
	4076.1	8.4	Mj	4115.6	10.8	Mz
	4078.2	8.2	Ch	4116.5	10.6	Ms
	4081.0	8.4	Mj	4118.5	10.9	Ms
	4085.0	8.7	Mj	4122.6	11.1	Cy
	4089.2	9.0	Ch	4128.5	10.6	B
	4095.0	8.9	Mj	4133.6	11.1	Bi
	4104.5	10.0	Cy			

VARIABLE STAR OBSERVATIONS RECEIVED DURING DECEMBER, 1924—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
194348 TU CYGNI—						
	4078.2	[11.2	Ch	4118.6	9.8	Bi
	4089.2	11.9	Ch	4121.6	9.2	Lv
	4111.5	9.9	Pt	4128.5	9.1	B
	4112.5	9.3	B	4133.6	9.6	Bi
194604 X AQUILAE—						
	4111.5	14.0	Pt	4114.5	13.1	Ie
194632 χ CYGNI—						
	4060.0	9.8	Nk	4083.2	9.4	Ch
	4060.0	10.1	Kk	4085.2	9.3	Ch
	4068.1	10.2	Ch	4085.9	8.9	Kk
	4070.1	10.0	Ch	4089.1	9.3	Ch
	4072.2	9.8	Ch	4091.1	9.1	Ch
	4073.9	9.5	Nk	4093.2	8.8	Ch
	4075.9	9.2	Kk	4111.5	6.5	Pt
	4077.2	9.6	Ch	4115.6	6.3	Mz
	4079.0	9.9	Nk	4118.6	6.4	Ms
	4080.2	9.5	Ch	4125.5	5.9	Mz
	4081.0	9.9	Nk	4129.5	6.0	B
	4081.0	9.0	Kk	4135.5	6.0	Mh
	4082.9	8.9	Kk	4135.6	6.2	Mz
194930 RR SAGITTARII—						
	4069.0	6.8	Bl	4087.9	6.8	Bl
	4076.0	6.6	Bl			
195142 RU SAGITTARII—						
	4060.4	[12.5	Sm	4084.3	11.3	Sm
	4077.9	12.0	Bl	4088.0	10.9	Bl
	4079.3	11.6	Sm			
195202 RR AQUILAE—						
	4115.5	12.2	Pt	4117.5	12.6	B
195308 RS AQUILAE—						
	4115.5	11.1	B			
195553 NOVA CYGNI #3—						
	4080.2	11.8	Ch	4117.5	12.2	Pt
	4109.5	12.1	Pt	4121.5	12.2	Pt
	4112.6	12.2	B	4122.5	12.0	Ie
	4115.5	12.1	Pt	4134.5	11.9	Pt
	4115.6	[11.5	Mz			
195849 Z CYGNI—						
	4112.6	12.6	B	4121.5	12.9	Ie
	4115.5	12.6	Pt	4133.5	12.9	B
195855 S TELESCOPII—						
	4077.9	13.1	Bl			
200212 SY AQUILAE—						
	4110.6	[12.4	B	4125.5	[12.2	B
200357 S CYGNI—						
	4085.2	10.8	Ch	4115.6	10.7	B
	4092.2	10.5	Ch	4120.6	11.2	Lv
	4108.6	10.5	Bi	4124.6	10.9	Ie
	4112.7	10.5	Sg	4134.6	[11.7	Sg
	4115.5	11.0	Pt			
200514 R CAPRICORNI—						
	4086.1	11.8	Ch	4115.5	10.6	B
	4115.5	11.4	Pt	4132.5	10.0	B
200647 SV CYGNI—						
	4121.6	8.6	B			
200715a S AQUILAE—						
	4086.2	9.4	Ch	4115.5	9.9	Pt
	4114.6	10.0	B	4128.5	10.1	B
200715b RW AQUILAE—						
	4114.6	9.3	B	4128.5	9.3	B
	4115.5	9.0	Pt			
200747 R TELESCOPII—						
	4077.9	13.3	Bl			
200812 RU AQUILAE—						
	4117.6	13.0	Pt			
200822 W CAPRICORNI—						
	4077.9	12.3	Bl	4115.5	11.4	Pt
	4088.0	12.3	Bl			
200906 Z AQUILAE—						
	4109.5	11.7	Ie	4115.5	12.1	Pt
	4112.6	11.8	B	4135.5	11.6	B
200916 R SAGITTAE—						
	4114.6	9.5	B	4128.5	8.8	B
200938 RS CYGNI—						
	4068.2	9.0	Ch	4116.6	8.3	Ly
	4069.2	9.0	Ch	4116.6	8.2	Cy
	4072.2	9.0	Ch	4119.6	8.4	Ly
	4075.2	8.9	Ch	4122.5	8.2	Cy
	4079.2	8.9	Ch	4124.5	7.6	Ly
	4083.2	8.9	Ch	4124.6	8.1	Cy
	4087.2	8.9	Ch	4129.5	7.6	Cy
	4089.1	8.9	Ch	4134.6	7.1	Sg
	4103.6	8.3	Cy	4134.6	7.5	Ly
	4112.7	8.0	Sg	4140.6	7.4	Ly
	4115.5	7.3	Pt			
201008 R DELPHINI—						
	4086.2	8.7	Ch	4117.6	9.8	Mz
	4114.5	9.3	B	4124.5	9.3	Ie
	4115.5	9.4	Pt	4135.5	10.5	Mz
	4117.5	9.3	B			
201121 RT CAPRICORNI—						
	4115.5	6.3	Pt			
201130 SX CYGNI—						
	4104.7	13.1	Cy	4118.5	13.6	Ie
	4112.6	13.1	B	4118.5	12.9	Cy
	4115.5	13.6	Pt	4133.5	[13.3	B
201139 RT SAGITTARII—						
	4069.9	6.4	Bl	4088.0	7.5	Bl
	4078.0	7.8	Bl			
201437b WX CYGNI—						
	4079.1	10.5	Ch	4118.6	10.5	Cy
	4103.6	10.5	Cy	4118.6	10.3	Bi
	4104.6	10.3	Cy	4121.6	10.0	Lv
	4106.6	10.6	Cy	4122.5	10.7	Cy
	4107.6	10.4	Cy	4122.6	10.7	Cy
	4108.5	10.5	Cy	4124.6	10.5	Ie
	4108.6	9.3	Bi	4124.6	10.6	Ly
	4112.7	10.5	Sg	4129.5	10.7	Cy
	4115.5	10.0	Pt	4130.5	10.8	Cy
	4116.6	10.3	Ly	4133.6	10.4	B
	4116.6	10.5	Cy	4134.6	10.7	Sg
201647 U CYGNI—						
	4059.9	7.8	Kk	4088.0	7.2	Kk
	4061.9	7.6	Kk	4088.9	7.4	Kk
	4068.9	7.5	Kk	4095.0	7.6	Mj
	4069.1	7.7	Mj	4107.6	7.5	B
	4073.0	7.3	Kk	4110.8	7.7	Sg
	4073.9	7.3	Kk	4114.6	7.5	Jo

VARIABLE STAR OBSERVATIONS RECEIVED DURING DECEMBER, 1924—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
201647 U CYGNI—Continued.						
	4076.0	7.2	Mj	4115.5	7.5	Pt
	4079.0	7.2	Kk	4115.6	8.1	Mz
	4079.0	7.8	Nk	4116.5	7.4	Ms
	4081.0	7.2	Kk	4118.5	7.3	Ms
	4081.1	7.8	Mj	4121.5	8.2	Mh
	4082.9	7.2	Kk	4124.6	8.0	Jo
	4083.9	7.2	Kk	4125.5	8.2	Mz
	4084.9	7.5	Kk	4129.6	7.4	B
	4085.1	7.7	Mj	4133.5	8.1	Mh
	4085.1	8.0	Nk	4133.6	7.6	Sg
	4085.9	7.5	Kk	4135.5	8.8	Mz
202240 U MICROSCOPII—						
	4078.0	12.0	Bl	4088.0	10.8	Bl
202817 Z DELPHINI—						
	4107.6	[11.5	Mz	4122.6	11.3	Bi
	4108.6	10.2	Bi	4124.5	11.0	Ie
	4115.5	10.4	Pt	4128.6	10.9	B
	4115.6	11.2	Bi	4135.6	[11.5	Mz
	4117.6	11.1	Mz	4136.5	11.6	B
202946 SZ CYGNI—						
	4109.5	9.6	Pt	4120.5	9.0	Pt
	4110.5	9.7	Pt	4121.5	9.5	Pt
	4111.5	9.8	Pt	4121.6	9.6	B
	4115.5	9.6	Pt	4125.5	9.5	Pt
	4116.6	8.9	Pt	4134.5	8.9	Pt
	4117.5	8.7	Pt	4135.5	9.1	Pt
	4118.5	8.8	Pt			
202954 ST CYGNI—						
	4115.5	10.2	Pt	4121.5	10.7	Ie
	4116.6	10.0	Y	4133.6	11.1	B
203226 V VULPECULAE—						
	4115.5	8.9	Pt			
203429 R MICROSCOPII—						
	4069.9	10.8	Bl	4088.0	12.0	Bl
	4077.9	11.4	Bl			
203611 Y DELPHINI—						
	4133.5	13.5	B			
203816 S DELPHINI—						
	4076.0	12.1	Nk	4115.5	11.0	Pt
	4079.0	12.4	Nk	4128.6	10.3	B
	4081.1	11.1	Nk	4136.5	10.3	B
	4114.6	10.8	B			
203847 V CYGNI—						
	4079.2	10.5	Ch	4115.5	8.2	Pt
	4086.2	10.5	Ch	4115.6	8.9	Bi
	4092.2	9.5	Ch	4120.6	9.4	Lv
	4107.6	8.7	B	4128.5	8.1	B
	4108.6	8.7	Bi	4135.5	8.2	B
203905 Y AQUARII—						
	4115.5	12.5	B	4118.5	12.3	Cy
	4115.5	12.4	Pt	4132.5	12.6	B
201416 T DELPHINI—						
	4076.0	10.4	Nk	4115.5	12.0	Pt
	4079.0	10.1	Nk	4116.7	12.1	Sg
	4081.1	10.3	Nk	4118.5	12.4	Cy
	4085.2	11.2	Ch	4122.5	12.4	Ie
	4104.5	11.5	Cy	4133.5	12.6	B
	4114.6	12.0	B			
204102 V AQUARII—						
	4088.2	9.4	Ch	4129.5	8.9	B
	4115.5	8.4	Pt			
204215 U CAPRICORNI—						
	4077.9	[13.5	Bl	4135.5	12.7	B
	4088.0	[13.5	Bl			
204318 V DELPHINI—						
	4116.7	[12.7	Sg	4117.6	12.5	B
204405 T AQUARII—						
	4079.1	[11.0	Ch	4115.5	13.6	Pt
204846 RZ CYGNI—						
	4108.6	11.0	Bi	4120.6	11.7	Lv
	4110.8	11.8	Sg	4122.5	11.4	Ie
	4115.5	11.0	Pt	4135.5	11.5	B
	4118.6	11.1	Bi			
204954 S INDI—						
	4078.0	[13.5	Bl			
205017 X DELPHINI—						
	4108.6	8.7	Bi	4122.6	9.0	Bi
	4115.5	8.5	Pt	4128.5	8.8	B
205923 R VULPECULAE—						
	4108.6	11.2	Bi	4122.6	9.7	Bi
	4110.5	11.6	Ie	4128.6	9.6	B
	4115.5	10.6	Pt	4135.6	9.0	Mz
	4117.6	10.3	Mz			
210124 V CAPRICORNI—						
	4077.9	10.2	Bl	4088.0	8.6	Bl
210129 TW CYGNI—						
	4116.6	10.5	Y	4129.5	10.0	Ie
	4122.6	9.6	B	4136.5	10.5	B
210221 X CAPRICORNI—						
	4077.9	13.3	Bl			
210382 X CEPHEI—						
	4114.6	12.3	B	4135.5	13.1	B
	4119.7	12.3	Br			
210504 RS AQUARII—						
	4115.5	10.9	B	4132.5	9.8	B
210516 Z CAPRICORNI—						
	4117.5	14.1	Pt			
210868 T CEPHEI—						
	4063.0	9.2	Ik	4104.8	9.6	Cy
	4068.0	9.2	Ik	4111.5	8.9	Pt
	4076.0	9.4	Ik	4112.7	9.7	Sg
	4079.0	9.5	Ik	4114.6	10.0	Jo
	4081.0	9.5	Ik	4115.6	9.4	B
	4081.2	9.0	Ch	4116.6	9.7	Cy
	4082.0	9.5	Ik	4117.6	10.1	Mz
	4092.0	9.7	Ik	4132.6	9.3	B
210903 RR AQUARII—						
	4111.6	13.1	Pt	4115.5	[13.3	Ie
211614 X PEGASI—						
	4111.6	11.1	Pt	4125.6	10.8	B
	4114.5	11.7	Ie	4136.5	10.4	B
211615 T CAPRICORNI—						
	4061.0	13.0	Bl	4088.0	12.5	Bl
	4078.0	12.6	Bl			
212030 S MICROSCOPII—						
	4078.0	[13.4	Bl	4088.4	[12.4	Sm

VARIABLE STAR OBSERVATIONS RECEIVED DURING DECEMBER, 1924—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
212814 Y CAPRICORNI—						
	4078.0	13.1	Bl	4107.5	12.8	B
	4088.0	12.9	Bl			
213244 W CYGNI—						
	4061.9	6.0	Kk	4084.9	6.1	Kk
	4068.9	6.0	Kk	4085.9	6.4	Kk
	4073.9	6.2	Kk	4087.9	6.4	Kk
	4081.0	6.3	Kk	4088.9	6.5	Kk
213678 S CEPHEI—						
	4108.7	9.0	Bi	4117.5	9.8	Mz
	4111.6	8.4	Pt	4120.7	9.7	Lv
	4114.6	9.2	B			
213753 RU CYGNI—						
	4085.2	8.7	Ch	4118.6	8.0	Cy
	4104.6	8.3	Cy	4130.5	8.1	Cy
	4111.6	7.9	Pt			
213843 SS CYGNI—						
	4061.2	10.8	Nk	4116.5	11.6	Ie
	4071.2	11.4	Ch	4116.5	11.7	Cy
	4072.5	11.5	Ca	4116.5	11.7	Pt
	4072.5	11.5	Ie	4116.6	11.5	Y
	4072.5	11.6	Cy	4116.6	11.5	Br
	4072.5	11.8	Pt	4116.6	11.3	Ms
	4072.6	11.8	Bi	4116.6	11.2	Ly
	4073.9	11.9	Nk	4117.5	10.7	Ks
	4075.1	11.4	Ch	4117.5	10.8	Pt
	4076.2	11.7	Ch	4117.5	10.9	Ms
	4076	10.8	Kl	4117.6	10.8	Sg
	4077.2	11.5	Ch	4117.6	11.6	Mz
	4078.1	11.5	Ch	4117.6	11.2	B
	4079.0	11.1	Nk	4118.5	10.7	Pt
	4079.1	11.6	Ch	4118.5	10.9	Ms
	4080	10.7	Kl	4118.5	11.1	Ie
	4080.2	11.6	Ch	4118.5	10.8	Cy
	4081	10.4	Kl	4118.6	10.3	Wr
	4081.0	10.7	Nk	4119.5	10.1	Ly
	4081.1	11.5	Ch	4119.6	10.3	B
	4082	8.7	Kl	4119.6	10.6	Br
	4083	8.3	Kl	4119.7	10.6	Br
	4083.2	8.7	Ch	4120.5	10.0	Ly
	4084	8.6	Kl	4120.6	9.7	Lv
	4084.1	8.7	Ch	4121.6	9.7	Ie
	4085.1	8.7	Ch	4121.5	9.6	Pt
	4085	8.7	Kl	4121.6	9.6	Lv
	4086.2	9.2	Ch	4121.6	9.6	Bi
	4087.2	9.8	Ch	4121.6	9.4	Mz
	4088.2	9.3	Ch	4121.6	9.8	B
	4089	9.4	Kl	4122.4	9.4	Ie
	4089.0	9.5	Nk	4122.5	9.3	Pt
	4089.1	9.6	Ch	4122.5	9.8	Ly
	4090.2	10.5	Ch	4122.5	9.3	Cy
	4091	9.6	Kl	4122.6	9.4	Bi
	4091.1	11.1	Ch	4122.6	9.5	B
	4092.2	11.5	Ch	4124.5	8.7	Ly
	4093.2	11.6	Ch	4124.5	8.9	Ie
	4094.1	11.7	Ch	4124.6	8.8	B
	4100.7	11.7	Cy	4124.6	8.7	Cy
	4102.7	11.9	Cy	4125.6	8.7	B
	4103.5	11.9	Cy	4125.6	8.9	Mz
	4104.5	11.9	Cy	4127.5	8.9	Cy
213843 SS CYGNI—Continued.						
	4106.6	11.7	Br	4127.6	9.1	Br
	4105.6	11.9	Cy	4128.6	9.7	B
	4107.6	11.7	Cy	4128.6	9.5	Br
	4107.6	11.5	B	4129.5	9.5	Ie
	4108.5	11.7	Cy	4129.5	9.8	Cy
	4108.5	11.5	Ie	4129.5	9.9	B
	4108.6	11.6	Br	4129.6	9.6	Lv
	4108.6	11.3	Ms	4130.5	9.9	Cy
	4109.5	11.9	Ie	4130.5	9.8	Ie
	4109.5	11.6	Pt	4131.5	10.3	Ie
	4110.5	11.5	Ie	4131.6	10.7	Cy
	4110.5	11.4	Pt	4132.5	11.2	B
	4110.6	11.8	Sg	4133.6	11.2	B
	4111.5	11.6	Pt	4133.6	11.8	Sg
	4112.6	11.6	B	4133.6	11.2	Lv
	4113.6	11.6	Br	4133.6	11.1	Ks
	4113.7	10.8	Sg	4133.6	11.2	Bi
	4114.5	11.6	Ie	4134.5	11.7	Ie
	4114.6	11.5	B	4134.5	11.0	Ly
	4114.6	11.6	Mz	4134.5	11.6	Pt
	4115.5	11.7	Pt	4135.5	11.6	Pt
	4115.5	11.6	Ie	4135.6	11.6	Mz
	4115.6	11.5	Br	4135.6	11.6	B
	4115.7	11.7	Cy	4136.6	11.9	B
	4115.7	11.6	Mz	4140.6	11.6	Ly
	4115.7	11.9	Br			
213937 RV CYGNI—						
	4111.6	6.5	Pt			
214024 RR PEGASI—						
	4111.6	13.0	Pt	4132.5	12.0	B
	4115.6	13.1	B	4135.6	11.2	Mz
	4130.5	11.6	Cy			
214274 R GRUIS—						
	4060.3	8.3	Sm	4079.4	8.9	Sm
	4069.9	8.8	Bl	4084.4	9.2	Sm
	4078.0	8.9	Bl	4088.0	9.5	Bl
215605 V PEGASI—						
	4118.5	[12.7	Cy	4135.6	[14.0	B
215717 U AQUARII—						
	4111.6	11.6	Pt	4115.5	11.4	B
215934 RT PEGASI—						
	4108.7	13.5	Bi	4115.7	13.5	Bi
220133a RY PEGASI—						
	4119.6	12.6	B	4132.6	12.3	B
220133b RZ PEGASI—						
	4106.6	12.5	Br	4132.6	11.7	B
	4119.6	11.8	B			
220412 T PEGASI—						
	4088.2	[11.6	Ch	4132.5	[13.2	B
	4115.6	[13.5	B			
220613 Y PEGASI—						
	4108.7	[13.6	Bi	4133.6	[13.0	B
	4115.7	[13.6	Bi			
220714 RS PEGASI—						
	4108.7	9.0	Bi	4122.6	9.5	Bi
	4111.6	8.8	Pt	4133.6	9.9	B
	4115.7	9.4	Bi			

VARIABLE STAR OBSERVATIONS RECEIVED DURING DECEMBER, 1924—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
221938 T GRUIS—						
	4046.3	8.7	Sm	4084.4	9.2	Sm
	4079.4	9.2	Sm			
221948 S GRUIS—						
	4060.3	12.5	Sm	4084.4	12.2	Sm
	4079.4	12.2	Sm			
222129 RV PEGASI—						
	4122.6	11.1	B	4133.6	11.4	B
222439 S LACERTAE—						
	4088.0	10.2	Ch	4121.6	9.8	Mz
	4108.7	9.6	Bi	4129.6	8.0	Ie
	4111.6	9.6	Pt	4129.6	8.4	Lv
	4119.6	9.0	B	4133.6	8.0	Lv
	4121.6	8.9	Lv	4132.6	8.2	B
222867 R INDI—						
	4069.0	8.9	Bl	4088.0	8.7	Bl
	4078.0	8.8	Bl			
223462 T TUCANAE—						
	4085.4	11.8	Sm			
223841 R LACERTAE—						
	4088.0	9.6	Ch	4121.6	9.1	Mz
	4111.6	8.5	Pt	4133.6	9.1	Lv
	4121.6	9.0	Lv	4135.6	9.5	Mz
225120 S AQUARII—						
	4116.6	11.1	Y	4135.5	9.8	B
225914 RW PEGASI—						
	4134.5	[13.4	Ie	4135.6	14.0	B
230110 R PEGASI—						
	4111.6	13.0	Pt	4118.5	13.2	Cd
	4114.5	13.1	Ie	4121.6	[10.1	Mz
	4116.7	12.9	Sg	4141.5	12.6	Cd
230759 V CASSIOPEIAE—						
	4104.8	11.2	Cy	4128.6	11.1	B
	4110.8	11.2	Sg	4130.7	11.1	Cy
	4111.6	11.1	Pt	4130.7	11.0	Hy
	4115.7	11.3	Cy	4135.6	11.2	Mz
	4119.6	11.0	B			
231425 W PEGASI—						
	4076	10.3	Kl	4088	8.8	Kl
	4080	9.4	Kl	4091	8.8	Kl
	4081	9.1	Kl	4098	8.4	Kl
	4082	9.1	Kl	4100	8.4	Kl
	4083	9.1	Kl	4108.7	8.3	Bi
	4083.0	9.0	Ch	4121.6	8.5	Lv
	4084	9.1	Kl	4133.6	9.0	Lv
	4085	9.0	Kl			
231508 S PEGASI—						
	4081.1	11.0	Ch	4122.6	8.8	B
	4111.6	9.6	Pt	4133.6	8.7	B
	4113.6	9.7	Br			
232746 V PHOENICIS—						
	4060.3	12.0	Sm	4088.4	10.6	Sm
	4081.3	10.4	Sm			
232848 Z ANDROMEDAE—						
	4081.1	[10.4	Ch	4103.0	10.0	Mj
	4097.0	9.9	Mj	4111.6	9.8	Pt
233335 ST ANDROMEDAE—						
	4081.0	8.8	Ch	4119.6	8.9	B
	4110.8	9.2	Sg	4132.6	8.9	B
	4111.6	8.7	Pt			
233815 R AQUARII—						
	4079.1	10.5	Ch	4116.6	10.2	Ly
	4108.5	10.1	Ms	4118.5	10.1	Ms
	4111.6	10.3	Pt	4129.5	9.4	B
	4116.5	10.1	Ms			
233956 Z CASSIOPEIAE—						
	4108.7	12.6	Bi	4122.6	12.9	Ie
	4114.6	12.9	B	4133.5	13.1	Lv
	4120.7	13.1	Lv	4136.6	13.3	B
235053 RR CASSIOPEIAE—						
	4081.1	[10.2	Ch	4122.6	[11.7	Ie
	4119.6	13.8	B	4136.6	[13.0	B
235209 V CETI—						
	4078.0	[13.6	Bl	4113.6	[13.6	Br
235265 R TUCANAE—						
	4060.3	11.8	Sm	4084.3	[12.9	Sm
	4079.3	12.9	Sm			
235350 R CASSIOPEIAE—						
	4081.2	[11.4	Ch	4124.6	10.4	B
	4104.8	12.0	Cy	4133.6	11.3	Ie
	4106.7	12.2	Br	4136.6	10.3	B
	4108.7	11.6	Bi			
235525 Z PEGASI—						
	4131.5	8.7	Ie			
235855 Y CASSIOPEIAE—						
	4135.6	[13.2	B			
235939 SV ANDROMEDAE—						
	4108.7	[13.5	Bi	4121.6	12.8	Lv
	4115.7	13.4	Bi	4133.6	[12.8	Lv
	4116.5	12.7	Ie			

Total number of stars observed	364
Total number of observations	1800

The Jewett telescope has been loaned to Mr. L. E. Cunningham, of North Cohasset, Mass. Mr. W. H. Smith, of Capetown, South Africa, has requested that his observations appear with those of other southern contributors and, accordingly, from now on they will appear regularly in these reports.

SS Aurigae, 060547, between the last two maxima, remained at minimum for 109 days, and at no time was there a gap of more than two days in the continuity of observations. This indicates the added value of coöperative work.

We hope soon to assign still other irregular variables to our more experienced observers, especially those having large instruments.

All the observations in the following table having been made during 1924, the decimal of day is referred to the astronomical day beginning at Greenwich Noon, as formerly.

The following observers have contributed to this report ending December 31, 1924: Allen, "Al"; Baldwin, "Bl"; Berman, "Bi"; Bouton, "B"; Brocchi, "Br"; Carr, "Ca"; Chandra, "Ch"; Cilley, "Cy"; Gaebler, "Gb"; Hama, "H"; Henry, "Hy"; Mrs. Holmes, "Ho"; Hubbard, "Hb"; Hunter, "Hu"; Iedema, "Ie"; Ikeda, "Ik"; Jones, "Jo"; K. Kasai, "Kk"; Kleis, "Ks"; Köhl, "Kl"; Leavenworth, "Lv"; Mrs. Lytle, "Ly"; Marks, "Mx"; Marshall, "Mh"; Miayajima, "Mj"; Mitchell, "Mz"; Mrs. Morris, "Ms"; Nakamura, "Nk"; Peltier, "Pt"; Skaggs, "Sg"; Smith, "Sm"; Whittier, "Wr", Miss Young, "Y".

LEON CAMPBELL, Recording Secretary.

COMET AND ASTEROID NOTES.

Baade's Asteroid 1924 (T D).—Baade's asteroid is following very closely the ephemeris given in the January number of POPULAR ASTRONOMY. A photograph was obtained at Goodsell Observatory on January 6. The object was of approximately magnitude 12.

Wolf's New Object (Comet *d* 1924).—Two more positions of the object discovered by Wolf on December 23 have been received by cablegram from Copenhagen to Harvard College Observatory. In the last cablegram the object is called a comet and its magnitude is given as 17. It is therefore probably not visible with small telescopes. It is moving very slowly south and a little west about midway between the Pleiades and the Hyades and during February will be just a little west of the Hyades. The following are all the observed positions which have come to hand:

		h m s	° ′ ″		
	G. M. T.				
1924 Dec.	23.3442	4 08 19.5	+24 31 36	Wolf	Königsberg
	26.3328	4 07 05	+23 50 24	Schorr	Bergedorf
	G. C. T.				
1925 Jan.	13.7490	4 04 48.0	+20 14 54	Wolf	Königsberg

The first two times are given according to the old style and the last according to the new style of reckoning. The last two positions are referred to the equinox of 1925.0; for the first no indication of the equinox was given in the cablegram.

Elements of the Orbit of Asteroid 1923 PE.—Mr. F. E. Seagrave sends us the following elements of the orbit of the asteroid 1923 PE, discovered by Peters at Washington, D. C.:

ELEMENTS OF ASTEROID 1923 PE.

E	=	Dec. 2.13689 G.C.T.			
M	=	0°	25′	29″.19	
ω	=	183	42	0.46	
π	=	53	26	9.16	
Ω	=	229	44	8.70	
i	=	15	30	9.12	

$\log a = 0.4073306$
$\log e = 9.6448780$
$\log q = 0.1543953$
$\mu = 868''.9818$
$P = 1491.401$ days

CONSTANTS.

$$x = r\,[9.9907741]\ \sin\ (318^\circ\ 41'\ 8''.10 + u)$$
$$y = r\,[9.9887255]\ \sin\ (225\ \ 55\ \ 44.14 + u)$$
$$z = r\,[9.4823502]\ \sin\ (269\ \ 30\ \ 30.55 + u)$$

Ephemeris of Baade's Asteroid 1924 TD.—Professor A. O. Leuschner sends the following ephemeris of Baade's Asteroid, computed by Dr. H. Thiele, of the Berkeley Astronomical Department, University of California.

CONTINUATION OF EPHEMERIS OF OBJECT BAADE (1924) FROM MANUSCRIPT ELEMENTS.

Correction to this ephemeris 1925 Jan. 5 $\Delta\alpha = +1^s.05$ $\Delta\delta = +4''.5$

Gr. Civil Time		True α h m s	True δ ° ′ ″	Log ρ	Log r
1925 Feb.	1	2 31 25.6	—2 22 5	.2113	.2556
	2	2 33 30.9	—2 15 39	.2156	
	3	2 35 35.8	—2 9 10	.2198	
	4	2 37 40.2	—2 2 40	.2240	
	5	2 39 44.2	—1 56 8	.2282	
	6	2 41 47.9	—1 49 35	.2323	
	7	2 43 51.1	—1 43 0	.2364	
	8	2 45 54.0	—1 36 24	.2405	
	9	2 47 56.4	—1 29 47	.2445	
	10	2 49 58.5	—1 23 10	.2485	
	11	2 52 0.3	—1 16 32	.2525	
	12	2 54 1.7	—1 9 54	.2564	
	13	2 56 2.8	—1 3 15	.2603	.2747
	14	2 58 3.6	—0 56 36	.2642	
	15	3 0 4.0	—0 49 58	.2680	
	16	3 2 4.2	—0 43 20	.2718	
	17	3 4 4.1	—0 36 43	.2756	
	18	3 6 3.8	—0 30 6	.2794	
	19	3 8 3.1	—0 23 31	.2831	
	20	3 10 2.2	—0 16 56	.2868	
	21	3 12 1.0	—0 10 22	.2904	
	22	3 13 58.7	—0 3 50	.2941	
	23	3 15 58.1	+0 2 41	.2977	
	24	3 17 56.2	+0 9 10	.3013	
	25	3 19 54.2	+0 15 38	.3048	.2930
	26	3 21 51.9	+0 22 3	.3083	
	27	3 23 49.4	+0 28 27	.3118	
	28	3 25 46.7	+0 34 48	.3152	
March	1	3 27 43.8	+0 41 7	.3186	

Elements of Wolf's Comet *d* 1924. — Copenhagen Circular No. 56, which comes just as we are closing up the last form in this issue of POPULAR ASTRONOMY, gives the following elements and ephemeris of the comet, computed by Dr. A. Kahrstedt of Berlin-Dahlem from observations made at Königstuhl December 22, 23 and 25.

1924 Dec. 25.5 Gr. M. T. (Old Style)

$$M = 351^\circ\ 51'\ 56''.7$$
$$\omega = 219\ \ 32\ \ 38.0$$
$$\Omega = 264\ \ 47\ \ 14.8 \quad 1924.0$$
$$i = 14\ \ 47\ \ 11.3$$
$$\phi = 40\ \ 27\ \ 44.4$$
$$\mu = 319''.231$$
$$\log a = 0.697268$$

EPHEMERIS 0^h GR. CIVIL TIME

1925		α 1925.0 h m	δ 1925.0 ° ′
Jan.	6	4 5.1	+21 35
	14	4 6.4	20 0
	22	4 10.2	18 38
	30	4 16.4	17 29
Febr.	7	4 25.0	+16 31

Mag. = 16^m

GENERAL NOTES

Dr. Frank Schlesinger accompanied by Mrs. Schlesinger sailed from New York on December 27 for South Africa via England. He took with him the 26-inch photographic objective intended for the Yale Southern Telescope. After selecting the exact site, work will be begun at once on erecting the observatory and mounting the telescope, which he hopes to have in operation by May or June.

The mounting for the telescope was constructed for the most part in the Yale Observatory shop at New Haven, and was temporarily erected in New Haven. It has now been crated and will be shipped direct from New York to South Africa at the end of January. Mr. Walter O'Connell, foreman of the shop, is to accompany the mounting and to take part in its erection in South Africa.

Dr. H. L. Alden, now of the McCormick Observatory, has been appointed Assistant Professor of Astronomy at Yale University and will be in charge of the Yale station in South Africa. He expects to sail from New York at the end of April and begin work with the telescope in June, when Dr. Schlesinger will return to this country.

Mr. C. H. Hall, Jr., formerly in charge of the Observatory of the Maryland Academy of Sciences, has been appointed assistant to Dr. Alden in the operation of the telescope. He will arrive at the station early in February.

We hope to publish in the near future a brief description of this telescope, illustrated with photographs taken at the southern site.

New Observatory in Java. — A new observatory has been established by the Dutch East Indian Astronomical Society at Lembang, Java. It is to be known as the Bosscha Observatory. The foundation of this observatory, as we learn from the 1924 December 30 number of the *Bulletin of the Astronomical Institutes of the Netherlands,* "was made possible by the liberality of several private persons and trading and other companies, and particularly of the man whose name it bears. His special donation is a refractor with English mounting, consisting of a visual and a photographic 60 cm (24-inch) telescope. The refractor, together with the dome and the rising floor have been ordered from the firm of Carl Zeiss, and will be entirely completed by the end of 1925.

"The instrument will be used principally for the determination of the parallaxes of the southern stars."

The announcement is accompanied with the request that astronomers and scientific institutions will send their publications to the newly founded observatory.

The position of the observatory is in longitude $7^h\ 10^m\ 27^s.81$ east from Greenwich and in latitude $-6°\ 49'\ 29''.1$. Altitude 1300 meters.

Astronomischer Jahresbericht. — Professor Kopff, director of the Astronomisches Rechen-Institut, from which the Astronomischer Jahresbericht is issued annually, desires to have duplicate copies of all astronomical articles sent to him in order that the references in the Annual Report should be complete. One copy should be sent to the Rechen-Institut and the other to the Jahresbericht. The address is Berlin-Dahlem, Altensteinstrasse 40, Germany. He also invites suggestions for the betterment of the Jahresbericht.

Orbit of β 416. — In *Bulletin of the Astronomical Institutes of the Netherlands* No. 70, Mr. J. Voûte gives corrected elements of the orbit of the double star β (Burnham) 416. This star is a bright pair, 6.0 8.0, with a proper motion according to Boss' Preliminary General Catalogue of $+0^s0959$ in right ascension and $-0''179$ in declination. Its position for 1900.0 is

$$\alpha\ 17^h\ 12^m\ 08^s75;\quad \delta -34°\ 52'\ 39''9.$$

The elements of the orbit as determined by Voûte are:

Time of periastron	T =	42.2 years
Period	P =	1891.48
Eccentricity	e =	0.551
Semimajor axis	a =	$1''83$
Node	Ω =	$130°2$
Inclination	i =	$\pm 50°4$
Periastron-node	ω =	$296°0$

Direction of motion retrograde.

Distance of the Andromeda Nebula. — For some years there has been a discussion in astronomical circles concerning the character of this nebula. The spectrographic evidence had favored the view of its being a galaxy somewhat like our own but at a great distance. The discovery of a number of novae by Ritchey, Curtis and others was another bit of evidence in the same direction, for if these novae in the nebula are of the same absolute magnitude as those of our Milky Way, then this object is at least 600,000 light years distant. A third contribution has been made by Hubble of the Mt. Wilson Observatory in a paper presented at the meeting of the American Astronomical Society in Washington during the holidays. In this paper it was announced that a considerable number of variable stars had been discovered and that about a dozen of them were of the Delta Cephei type. By applying Shapley's period-luminosity law to these Cepheid variables their distance, and therefore also the distance of the nebula, is about 950,000 light years. It was also stated that the number of novae in the Andromeda nebula had now reached a total of 44 and that the outer parts of the nebula, usually photographed as nebulosity, had been resolved into myriads of stars on photographs taken with the 100-inch reflector.

Similar methods applied by Hubble to the great spiral, M 33, gave its distance as equal to that of the Andromeda nebula. The evidence thus presented is in favor of the "island universe" theory.

The Brightness of a Star a Million Light Years Away.—A correspondent asks us how much brighter than the sun is a star whose magnitude is seven at a distance of a million light years. To compare the absolute brightness of stars we reduce them to the distance where the parallax is $0''1$ or 10 parsecs. A million light years is equal approximately to 300,000 parsecs, so the 7th magnitude star at that distance is 30,000 times the standard distance of 10 parsecs. If

it were brought up to 10 parsecs distance its light would be increased $30{,}000^2$ times. The sun if removed to 10 parsecs would have a magnitude of 5.0 according to the usual estimates, which is about 6¼ times as bright as a 7th magnitude star. Hence the star in question would be $30{,}000^2$ divided by 6¼, or about 140,000,000, times as bright as the sun.

ECLIPSE NOTES.

We expect to give in the March number of POPULAR ASTRONOMY as full reports as we may obtain concerning the observations of the total eclipse of January 24. From the daily newspapers all will have learned that the western half of the eclipse track across the United States was entirely overcast by clouds but that in New York and Connecticut the weather was generally clear, so that the programs of the many observers stationed there were successfully carried out. Although our own party was in the cloudy area, we rejoice that the majority of the well-equipped observing parties were favored with such splendid weather conditions.

The following preliminary reports have been received:

BAYFIELD, WISCONSIN. Goodsell Observatory Station. Fath, Wilson and five students, many visitors. Sky densely overcast.

IRON MOUNTAIN, MICHIGAN. Yerkes Observatory Station. Ross and Lee, many hundred others. Totally cloudy all morning. Preparations perfect. Nothing done.

ITHACA, N. Y. Parkhurst of Yerkes Observatory. Sky clear. Observations complete.

BINGHAMTON, N. Y. Blakslee of Yerkes Observatory. Carried out most of program. Clouds interfered some at totality.

POUGHKEEPSIE, N. Y. Vassar College Observatory. Miss Caroline E. Furness and students. Sky remarkably clear. Photographic program with twelve-inch telescope carried out successfully. Eight exposures during totality for corona, and twelve after totality for position of moon. Shadow bands well marked. Satisfactory observations by students, members of Physics Department, Miss Cannon, Dr. Waldo and others.

MIDDLETOWN, CONN. Van Vleck Observatory. Frederic Slocum. First contact lost on account of clouds. Sky cleared half hour before totality. All program apparently successful. Other institutions represented here: Mount Wilson Observatory, University of Virginia, University of Wisconsin, University of Illinois, Harvard University, Brown University, Williams College, Smith College, Bureau of Standards, University of Louvain, Hungarian National Observatory.

NANTUCKET ISLAND. Maria Mitchell Observatory. Margaret Harwood cooperating with Harvard University. Eight-inch reflector, Harwood and Payne, five corona photographs for photometry and contacts. Three-inch visual, Brock, contacts. Coronal photometer, King, eight exposures, other photometric tests. Direct photographs and shadow bands observed by local residents.

Mrs. Elizabeth Struve, mother of Dr. Otto Struve, had been commissioned as our special representative on the High Seas, and the Captain of the Steamer *Albert Ballin* of the Hamburg-American Line had promised to give her every facility for observing the eclipse from the steamer. We assume that it was in the zone of totality, with the sun at a favorable elevation. She will probably land on Tuesday.

EDWIN B. FROST.